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NOTICES AND DESCRIPTIONS OF FOSSILS, FROM THE MARSHALL GROUP[112] OF THE WESTERN STATES, WITH NOTES ON FOSSILS FROM OTHER FORMATIONS.

By Alexander Winchell, Director of the Geological Survey of Michigan.

The following notices and descriptions were drawn up in March last, but their publication has been delayed by pressing and unremitting engagements, which continued, very unexpectedly, through the entire Summer.

These studies are based chiefly on specimens from Tennessee and Ohio. The Tennessee specimens were submitted (with others) by Prof. James M. Safford, about three years ago, and the conclusions have very recently been announced in his Report on the Geology of that State. The Ohio specimens consist of fossils communicated from time to time, during two or three years past, by Rev. Herman Herzer, and of a series of fossils collected by Prof. E. Andrews, along a section extending from the Blue Limestone, near Cincinnati, along the Ohio river to the Coal Measures,[113] and others collected in Central Ohio and western Pennsylvania.

In order that the references in the following pages may be made intelligible, I subjoin the section communicated by Prof. Andrews:

Section along Ohio river from Adams to Lawrence counties, Ohio.

Coal Measures.

No. 1.	Measures embracing beds of Iron Ore	207 ft.
	Coal, Underlying measures,	157 "
No. 2.	Coarse-grained sandstone of Coal Measures, Clays and Iron Ore,	38 "
No. 3.	"Sub-carboniferous Limestone" of Ky., overlying the "Knobs" of the Kentucky Reports,	46 "

Waverly Series.

No. 4.	Sandstones containing, above, marine plants, *cauda-galli* and other fucoids, and near the bottom, nodules of Kidney Iron Ore. At the bottom is a mass of sandstone and Iron Ore embracing, probably, the fossils of Sciotoville, Flagg's Hill, &c.	258 "
	Sandstones	114 "
No. 5.	Fossiliferous ferruginous sandstone of Rockville, Sandstones with Fucoids, Shales containing the *Goniatites* described by Dr. Hildreth,	127 "
No. 6.	"City Ledge," 5 ft. above black shale	4 "
	Waverly black shale. Fish-bed, *Lingula subspatulata, Discina capax?* Ganoid scales, &c.	16 "
	Lower Waverly beds with Fucoids	127 "

[112] For other papers by the author, on the Geology and Paleontology of this group, see "First Biennial Report" of the Geological Survey of Michigan, 1860; Amer. Jour. Sci. and Arts [2] vol. xxxiii, p. 352; ib. xxxv, p. 61; Proc. Acad. Nat. Sci., Phil., Sept., 1862, p. 465; ib. Jan., 1863, p. 2; ib. July 1865; Pro. Amer. Phil. Soc., No. 81, (vol. xi) 1869, p. 57; Geology of Tenn., 1869, pp. 364-5 and 440.

[113] This section was read in substance, at the Chicago meeting of the American Association, in Aug., 1868.

No. 7. Ohio Black Shale, embracing beds of fire-clay and *septaria*, 320 "

No. 8. { Buff-colored limestone, arenaceous ("Cliff Limestone") with beds of lenticular Iron Ore near the bottom.

No. 9. Brown and light colored clays (Dr. Locke's "Marl").

No. 10. { Middle or Flinty Limestone, underlaid by yellow clay containing thin layers of limestone.

No. 11. Blue Limestone.

The "Waverly," of Ohio, is regarded by Prof. Andrews, as extending from the "Subcarboniferous Limestone (No. 3), to the "Ohio Black Shale" (No. 7). The Chemung and Portage may be embraced in No. 6.

No. 7 is generally regarded as the equivalent of the "Genesee Shale," of New York.

No. 8 is found to contain the following Niagara species: *Trematopora tubulosa*, Hall; *Caryocrinus ornatus*, Say; *Retepora aspero-striata*, Hall; *Obolus imbricatus*, n. sp.;[114] *strophomena striata*, Hall; *S. rhomboidalis*, Wahl; *S. Niagarensis*, Win. & Mar.; *Hemipronites subplanus*, Con. sp.;[115] *H. hemiaster*, Win. & Mar.; *Orthis elegantula*, Dalm. sp.; *Cornulites flexuosus*, Hall;[116] *Spirifra sulcata*, Hising, sp; *Atrypa reticularis*, Dalm. A. *neglecta*, Hall; *A. cuneata*, Hall; *Meristella nitida*, Hall, *Pentamerus* sp?; *Platyostoma Niagarense?* Hall,[117] *Orthoceras* sp?; *Dalmania limulurus*, Green sp., *Calymene Niagarensis*, Hall.

No. 9 of Andrews' section contains the following species, some of which are known to belong to the Clinton group: *Rusophycus clavatus* and *bilobatus*, Hall; *Fenestella prisca*, Hall, and *Obolus imbricatus?* n. sp.

It will be noticed that the characteristic fossils of the Waverly Group are traced to near Shafer's, on Oil Creek, Pa., at a locality said to be "200 to 300 feet below the coal," where we find such species as *Chonetes pulchella* Win.; *Lingula membranacea* Win.; *Hemipronites inequalis*, Hall sp.; *Syringothyris typa*, Win.; *Spirifera Carteri*, Hall; *Discina Gallaheri*, Win.; with others common to the Waverly and later formations. At Kinzua, Pa., however, which is stated to be "300 or 400 feet below the Coal Conglomerate," we seem to have passed into the limits of another fauna. Not a single species can be recognized as belonging to the Waverly. On the contrary, *Spirifera disjuncta* (Phillips) Hall, a species of the Chemung Group, of New York, is conspicuous and well determined. Fragments of lamellibranchs which appear to belong to the Chemung

[114] Shell small, nearly circular, with a slightly projecting beak in the ventral valve, false area very small and inconspicuous, central median ridge distinct but delicate, becoming broader anteriorly, and vanishing in front of the centre; a longitudinally oval scar on each side of the central ridge. Surface marked, especially in the older shells, by numerous concentric imbricating lamellae of growth. Transverse diameter 5-16 inch; length of ventral valve about the same. This is a smaller species than *O. Conradi*, Hall, with a more lamellose exterior, and, so far as I have been able to observe, a different cardinal structure.

[115] Several specimens, agreeing very well with the description and figures of New York specimens, but apparently *not* the same as the Illinois specimens referred to this species. (Ill. Geol. Rep III, 349).

[116] The single specimen has the rings somewhat constricted below, instead of regularly convex as in *C. arcuatus* Con.

[117] A carinated shell, more appressed laterally than the carinated varieties figured by Prof. Hall.

species *Avicula longispina* and *acanthoptera*, Hall, are also abundant, as well as a *Rhynchonella*, which differs from any known Waverly species.

It seems, therefore, from these indications, that the line separating the Chemung and Waverly, passes between these two horizons; and that we have here positive paleontological and stratigraphical evidence of the superposition of the Waverly above the Chemung, as I have heretofore argued.[118]

The fossils from Tennessee identified with species of the age of the Marshall (or Waverly) Group, will undoubtedly be regarded as possessing considerable interest, as this is the first paleontological determination of the extension of this group into that State. They are mostly embraced in a thin deposit of dark, silicious, bituminous shales, emitting an agreeable aromatic odor,[119] and resembling in physical characters, the shales of the Kinderhook Group, of Illinois. This resemblance suggests the belief that the Hickman shales of Tennessee are a prolongation of the Kinderhook shales; and that they will yet be traced along both sides of the Coal Measures, from Indiana and Illinois across the western extremity of Kentucky.[120]

ZAPHRENTIS IDA? Win. (Proc. A. Nat. Sci., Phil., July, 1865). From Hickman county, Tenn., and Sciotoville, Ohio, (See Andrews' section). The Tennessee specimens are without epitheca, and lack the profound wrinkles of growth belonging to the types of this species, from Rockford, Ind. They also enlarge upward somewhat more rapidly. The Ohio specimen is extremely similar to these.

TREMATOPORA? VESICULOSA, Win. (Proc. A. Nat. Sci., Phil., Jan., 1863, p. 3). Several good specimens from Sciotoville, Ohio.

[118] See especially Proc. Amer. Phil. Soc., No. 81, p. 57, and Proc. Acad. Nat. Sci., Phil., July, 1865, p. 110.

[119] See further notices of these rocks, Geology of Tenn., chap. XI, sec. I.

[120] Descriptions of these fossils are embraced in the late Report on Tennessee, in a paper embodying notices of some fossils from the "Carboniferous Limestone," of that State. As Prof. Safford has questioned the correctness of my identification of *Spirifera Logani*, I embrace this opportunity to state that I have reinvestigated the question and remain of the same persuasion as before, though I admit there is room for differences of opinion. I have five specimens of *S. imbrex*, (to which Prof. Safford refers the specimens in question) from the typical locality, at Burlington, Iowa. The Tennessee specimens differ from these as follows: They are larger, heavier and coarser shells; the sinus is more deeply sunk, relatively broader, and more distinctly defined, and it is greatly produced in front, while that of *S. imbrex* is scarcely at all produced; it embraces from 10 to 12 costæ, while that of *S. imbrex* embraces only 6 or 8; the fold, instead of being obsolete, and a mere undefined swell, is raised into a prominent, crest-like, acute ridge, especially toward the front; the dorsal valve is flattened from the middle of the fold to the extremities; the area is not flat, and is striated in both directions; the costæ, besides being smaller, are less numerous, except in very old specimens; they are crossed only by fine concentric striae, and remote irregular grooves, instead of coarse, regular, imbricating striæ raised into nodes on the crests of the costæ, as is the case with the surface of *S. imbrex*, when well preserved.

On the contrary, these specimens agree with *S. Logani*, especially in the following distinctive characters; "Dorsal valve depressed toward the cardinal extremities, and broadly curving to the base; mesial fold very prominent, extremely elevated and subangular in front, not defined at the margins. Ventral valve very gibbous at the sides, marked by a broad, deep, undefined mesial sinus which, in the middle of the shell, occupies fully one-third of the width, sloping abruptly to the cardinal extremities, and extremely produced and elevated in front, in a sub-triangular extension;" the area is concave, vertically and longitudinally striate.

The correct identification of these Tennessee specimens is important, as having a bearing on the question of the equivalencies of the "Silicious Group," of Safford.

LINGULA SUBSPATULATA? M. & W. (Ill. Geol. Rep. III, 437, pl. 13, fig. 1). From Tennessee, and No. 6, Rockville, Ohio. The single specimen from Tennessee, showing the inside of (apparently) the ventral valve, is not over one-third the length of the specimen figured in the Illinois Report; but it otherwise agrees with the description in outline, surface markings, position of beak and faint radiating lines along the middle.

Lingula sub-spatulata was described from the "Black Slate," of Union county, Ill. At Vanceburg, Ky., and other localities on both sides of the Ohio river, is a black shale embraced within the Waverly series, (see No. 6, Andrews' section) which contains a small *Lingula*, not easily distinguishable from the Tennessee specimen. If the Ohio, Kentucky, and Tennessee specimens are really identifiable with the Illinois species, it appears strange that the latter should be found in a geological position so much lower. There seems to be occasion for the query, whether the Illinois equivalent of the Vanceburg Shale has not become confounded with the "Black Shale," by the disappearance of intervening beds; and also, whether the entire mass of the "Black Shale," of southern Ohio, Indiana and Illinois, does not, in fact, belong in a position considerably above the Genesee Shale, as Verneuil, Owen and others long ago suggested.[121]

I am led to suspect that *L. sub-spatulata*, M. & W., is identical with my *L. membranacea*.[122]

LINGULA MEMBRANACEA, Win. (Proc. Acad. N. S., Phil., Jan., 1863). From near Shafer's, Penn.

DISCINA SAFFORDI, n. sp.

Shell rather small, outline nearly circular, but generally a little flattened posteriorly, and also on each of the postero-lateral boundaries. Upper valve rather depressed conical, with the beak midway between the centre and the posterior side; under surface presenting a faint but distinct linear ridge extending anteriorly from the beak one-fourth the diameter of the shell. Lower valve very depressed convex, with an apical pyriform indentation having a blunt spur projecting from its broad anterior end; no perforation visible. Exterior of both valves ornamented with numerous fine, unequal, concentric striæ; interiors smooth, except the faint vascular markings near the borders.

This curious species most resembles in general appearance, *Discina Lodensis*, from the Genesee Shale; but the pyriform indentation of the ventral valve, the finer external striæ and the inconspicuous foramen will serve to distinguish it.

From dark bituminous Shales just above the "Black Slate," of Hickman county, Tennessee.

[121] The "Black Shale," of northern Ohio, Ontario and Michigan, is undoubtedly the "Genesee," as is proven both stratigraphically and paleontologically. (See Proc. Amer. Phil. Soc., No. 81, p. 77, &c.)

[122] I take occasion to remark that *Gyroceras? Rockfordensis*, M. & W., (Ill. Rep. III, p. 459) from Rockford, Ind., is identical with my *Cyrtoceras Rockfordense*, described in Proc. Acad. Nat. Sci. July, 1865.

DISCINA CAPAX? White (Proc. Bos. Soc. Nat. Hist.) From Black Shale (Bed No. 6), Rockville, Ohio.

These specimens resemble *D. Lodensis* in size and markings. They differ in the more prominent and more excentric beak of the dorsal valve. The striæ of *D. Lodensis* are also more regular and more sharply raised, and it is a larger species. It is smaller and thinner than the types of *D. capax*, but I hesitate to pronounce it distinct.

DISCINA GALLAHERI, Win. (Proc. A. N. S., Phil., July, 1865). Collected by Prof. Andrews, at Granville, Licking county, Ohio,—adherent on a *Spirifera;* also, from near Shafer's, Penn.

The Ohio specimens differ from *D. Gallaheri* only in size—being one-half the diameter, or less. The indentation of the dorsal valve is lenticular in outline, and extends nearly from the posterior margin to the centre of the valve. Along the middle of the indentation on the inside is a ribbon-shaped impression, bounded by a sharp, elevated ridge on each side, and divided by a similar, parallel ridge running along the middle of the impression. Each portion of this impression is marked by extremely delicate, raised, transverse lines, which would seem to indicate that the impressions are not the foramen, but a portion of the shell. The foramen may have been a delicate slit occupying the place of the median ridge dividing the two impressions. In *D. Saffordi* the foramen appears to be similarly wanting, and it may have been equally slit-like during life.

The Pennsylvania specimens are mere casts of the non-perforate valve, slightly oval in outline, with irregular, concentric wrinkles, a sub-central beak elevated one-third the smaller diameter of the valve. One of the three casts bears apparently the impressions of the ribs of some costate shell, suggesting that this individual, like the Ohio specimens, may have been parasitic. The larger of these casts are fourteen-sixteenths by eleven-sixteenths of an inch in diameter.

PRODUCTA CONCENTRICA, Hall (Iowa Geol. Rep. 517, pl. vii, fig. 3; 10 Rep. N. Y. Regents, 180; see also, Winchell, Proc. A. N. S., Phil., July, 1865, p. 115). From yellowish-brown calcareo-argillaceous beds, and from calcareo-silicious shales of Tennessee. Also, from Sciotoville, Ohio.

The Tennessee collection contains one specimen showing both valves, one showing the ventral, and one both sides of the dorsal valve. Another specimen exhibiting the exterior of a ventral valve, resembles the forms named *P. Shumardianus* by Prof. Hall; but this name is probably a synonym of *P. concentrica*.

PRODUCTA SEMIRETICULATA, Fleming.

Collected by Rev. H. Herzer, at Newark, Licking county, Ohio; by Prof. E. Andrews, at Sciotoville (where it is abundant); from bed No. 5, Rockville; from a point 2½ miles west of "Cincinnati Furnace," Vinton county, Ohio (in the upper Waverly); and in large and characteristic specimens from near Shafer's, on Oil Creek, Venango county, Penn.

PRODUCTA COOPERENSIS? Swallow.

From bed No. 4, Sciotoville, Ohio.

There are several specimens of this form, and they differ from specimens of *P. Cooperensis* from Burlington, Iowa, principally in a much shallower ventral sinus and a larger size. In size, and in the peculiar arrangement of the granulations of the inner surface, they resemble *P. duplicostata*, Win., but the costæ are less developed, and there are fewer spines distributed over the general surface. These forms resemble, not a little, *P. viminalis*, Hall, from the Burlington Limestone, but the costæ are less pronounced, and the ventral valve enlarges less rapidly. This is possibly the species which has sometimes been referred to *P. Cora*, D'Orb.

PRODUCTA GRACILIS? Win. (Proc. Acad. N. Sci., Phil., July, 1865.) From bed No. 4, Sciotoville, Ohio.

The numerous casts from this locality do not preserve the striations as strongly as the types of this species; but they are too broad for *P. parvula*, and the ventral valve is not sufficiently produced. It is desirable yet to make comparisons with specimens of *P. minuta*, Shum.

PRODUCTA MORBILLIANA, Win. (Phil. Proc., July, 1865, p. 113.) From bed No. 4, Sciotoville, Ohio.

PRODUCTA ARCUATA, Hall (Iowa Rep. 518, pl. vii, fig. 4, a. b). Quite abundant in bed No. 5, Rockville, Ohio. Quite identical forms occur also at Granville, O.

CHONETES MULTICOSTA, Win. (Proc. A. N. S., Phil., Jan., 1863, p. 5.) In yellowish-brown calcareo-argillaceous beds and dark bituminous shales in Hickman and Maury counties, Tennessee.

There are two dorsal valves in Prof. Safford's collection. They agree with this species, except that the striæ are considerably more obscure than even in the typical specimens; and the external surface is minutely granulated.

This species ranges from the base of the Yellow Sandstones, at Burlington, Iowa, into the base of the Burlington Limestone.

CHONETES PULCHELLA, Win. (Proc. A. N. Sci., Phila., Sept., 1862.) A single ventral valve occurs among the specimens from Tennessee. It exposes only the inside, and hence the number of ribs cannot be satisfactorily ascertained. A slightly divergent spine appears at each extremity of the hinge line.

Several clearly marked specimens from Newark, Ohio, occur in Prof. Andrews' collection. These exhibit, however, three or four hollow spines each side of the beak.

Other specimens from near Shafer's, on Oil Creek, Pa., are almost perfectly identical with these.

CHONETES FISCHERI, N. & P. (Jour. A. N. S., Phil., vol. I). From dark bituminous shales, Tennessee.

CHONETES GENICULATA? White (Proc. Bos. Soc. N. Hist. IX, 29). From bed No. 5, Rockville, Ohio.

The few imperfect specimens in the collection agree with forms occurring at Burlington, Iowa, in the Yellow Sandstones, and sometimes referred with doubt to *C. geniculata*. I suspect they may all prove to be *C.*

pulchella, Win. The type-specimens of *C. geniculata* are from Clarksville, Mo., and, besides presenting the characteristic geniculation in the ventral valve, appear to have a rather shorter hinge line than these specimens.

CHONETES ILLINOISENSIS, Worthen (Trans. St. Louis Acad. Sci. I, 571). Occurs in bed No. 5, Rockville, Ohio.

HEMIPRONITES INEQUALIS, Hall sp. (Io. Geol. Rep. 490, pl. ii, fig. 6, a—c.) Collected by Rev. H. Herzer, at Newark, Ohio, and by Prof. Andrews, at Granville. Collected, also, by the latter in Pennsylvania, near Shafer's.

HEMIPRONITES UMBRACULUM? Schloth. (Die Petrefact. I, p. 256, and II, p. 67.)

Collected by Rev. H. Herzer, at Newark, Ohio, and by Prof. Andrews, in bed No. 4, at Sciotoville and bed No. 5, Rockville, and also, near Shafer's, Penn.

It may well be doubted whether the large specimens ranging through the equivalents of the Marshall group, in the Western States, really belong to the foreign species to which they have generally been referred.

ORTHIS SUBELLIPTICA? W. & W. (Bos. Proc. VIII, 292.) From bed No. 4, Sciotoville, Ohio. A single imperfect specimen.

ORTHIS MICHELINI? L'Evéillé.

From bed No. 5, Rockville, Ohio; from Granville, Licking county; from Vinton county; and also, from near Shafer's, Penn.

The specimens from all these localities agree with each other and with specimens commonly referred to *O. Michelini*. It is a form probably identical with that from Clarksville, Mo., referred to *O. Vanuxemi*, by Prof. Hall. The smaller, flattened specimens approximate *O. flava*, Win., from the Burlington Sandstone, while a large, transversely oval specimen from Rockville, approaches *O. resupinata*, except in much smaller size. In the considerable convexity of some of the dorsal valves (especially from Shafer's), and also in the cast of the muscular scars, they differ from *O. impressa*, Hall. If there are any permanent specific distinctions among the widely extended American forms commonly referred to *O. Michelini*, it will require extended and careful comparisons to make them out.

SPIRIFERA HIRTA? White & Whitfield.

The single specimen from silicious Shales, Tennessee, is considerably larger than specimens from Burlington, Iowa, the typical locality, and perhaps the area is a little more extended laterally.

SPIRIFERA EXTENUATA, Hall (Iowa Rep. 520, pl. vii, fig. 6). Collected by Rev. H. Herzer and Prof. Andrews, at Newark, O.

SPIRIFERA WAVERLYENSIS, n. sp.

Shell semi-circular, without plications (on the cast). Ventral valve with an elevated, nearly flat, transversely furrowed and vertically striated area, reaching the whole length of the hinge-line, which is scarcely less than the greatest width of the valve. The plane of the area forms a right angle with the plane of the valve. Surface more rapidly convex near the margin than between the beak and the middle; lateral slopes, also, gently convex. Sinus deep, well defined, occupying nearly one-fourth the

width of the valve, slightly produced anteriorly. Dental lamellæ extending three-fifths the length of the valve, not approximated at the rostral extremity. Muscular scars striate. Surface of cast destitute of plications, but deeply marked toward the front by wrinkles of growth.

Transverse diameter, one and five-eighths inches; antero-posterior diameter, one inch; height of area, three-eighths of an inch.

This species is more completely destitute of plications than any other in rocks of the same age; and this character, together with the length, width and flatness of the area, renders it necessary to admit it as new.

SPIRIFERA CARTERI, Hall (*S. Vernonensis*, Swallow). Very abundant in bed No. 4, Sciotoville, Ohio; rare in bed No. 5, Rockville. A single specimen labelled Granville, is, probably (judging from the matrix), from Sciotoville. Occurs also, near Shafer's, Penn.

SPIRIFERA MARIONENSIS, Shum. (Mo. Geol. Rep., Pt. ii, p. 203, pl. C., fig. 8, a—d.) Several specimens from bed No. 4, Sciotoville, Ohio. These specimens agree tolerably well with the description of this species, and with specimens from Clarksville, Mo. This seems to be a species, however, which exhibits a tendency to graduate on the one hand, into *S. biplicata*, and on the other, into *S. Carteri* Young specimens exhibit a well defined ventral sinus, with about two incipient plications; and having, at this age, sharper dorso-lateral angles, they closely approximate *S. biplicata*. Large specimens, on the contrary, can scarcely be distinguished from *S. Carteri*, save by the less pronounced sinus and fold.

There are, indeed, six species described from rocks of this age, which need to be re-examined and compared, viz: *S. Marionensis*, Shum., 1855; *S. Carteri*, Hall, 1857–8; *S. biplicata*, Hall, 1858; *S. Vernonensis*, Swallow, 1860; *S. Osagensis*, Swal., 1860; and *S. Missouriensis*, Swal., 1860. The three first are, perhaps, distinct species—possibly all the others.

SPIRIFERA SUBROTUNDATA, Hall (Iowa Geol. Rep., p. 521). From bed No. 4, Sciotoville, Ohio.

On some of the casts no striations are certainly seen, except over a limited space one side of the beak.

SPIRIFERA BIPLICATA? Hall. A single imperfect specimen, from No. 4, Sciotoville, Ohio. See remarks above on *S. Marionensis*.

SPIRIFERINA SOLIDIROSTRIS, White (Bos. Jour. VII, 232). Collected by Rev. H. Herzer, at Newark, Ohio, and by Prof. Andrews, from bed No. 4, Sciotoville, and bed No. 5, Rockville.

SYRINGOTHYRIS TYPA, Win. (Proc. Acad. N. S., Phil.) This species occurs quite abundantly in Ohio. Mr. Herzer and Prof. Andrews have furnished over a dozen specimens from Newark. In bed No. 4, Sciotoville, it forms, with *Spirifera Carteri* and several other species, the principal mass of a highly ferruginous stratum of sandstone. It occurs freely, also, near Shafer's, in Pennsylvania.

From Newark specimens may be worked out good views of both valves, and of the bifariously striated area. Traces of the pseudo-deltidium may also be seen, and it appears that the dental lamellæ are very deep, but the essential structure of the genus does not appear. There is one exceptional

specimen, which may be a dorsal valve distorted by pressure exerted at the hinge extremities. If undistorted, it belongs, evidently, to a distinct species.

In many of the Sciotoville specimens, the fissured tube and other details of the internal structure of the genus are distinctly shown, but there is difficulty in isolating the specimens from the mass.

A specimen in Prof. Andrews' collection from Newark, which has the beak of the ventral valve somewhat less elevated than usual, and the area considerably vaulted, presents on the cast of this valve generic (?) characters which have not before been noticed. The whole width of the broad sinus, in the middle of the valve, is occupied by a pair of very peculiar occlusor scars, separated by the shallow impression of a low median ridge. Each scar appears somewhat like the representation of the head of a sheaf of wheat—the divergent and pendent heads of grain being turned toward the extremities of the shell. The two scars together are an inch broad, and of equal length. These characters recur in a specimen from Shafer's, Pennsylvania.

I have some suspicion that *Syringothyris typa* is identical with *Spirifera capax*, Hall. The principal distinction, so far as I observe, consists in the lobular, anterior prolongation of the ventral sinus of the former. In a specimen having a transverse diameter of $3\frac{1}{2}$ inches, and a height of area of $1\frac{3}{8}$ inches, the ventral sinus projects three-fourths of an inch beyond the general front of the shell. All of my specimens present this character; but it does not appear in the description and figures of *S. capax*. As this is a character which probably bears a relation to the age of the shell, it may be that *S. capax* was described from immature specimens. If so, this species should be known as *Syringothyris capax*.

Spirigera Hannibalensis, Swallow (St. Louis Trans. vol. I, p. 649). Several good casts from bed No. 4, Sciotoville, some of which show both valves. Impressions of the exterior are common, showing that this species flourished to luxuriant dimensions. A pair of spines is preserved, with a bit of smooth shell attached.

Spirigera Ohiensis, Win. (Proc. A. Nat. Sci., Phil., July, 1865, p. 118.) From bed No. 4, Sciotoville, Ohio.

Rhynchonella Sageriana, Win. (Proc. Acad. N. Sci., Phil., Sept., 1862, p. 407.) Six specimens from dark bituminous shales, Tennessee. Also, from Newark, Ohio; bed No. 4, Sciotoville; Granville (abundant,) and from "Cincinnati Furnace," Vinton county, where it is of frequent occurrence.

This is a common and widely distributed species. I have heretofore known it from remote parts of Michigan, and from Medina, Ashland, Cuyahoga, Summit and Licking counties, Ohio.

Rhynchonella Missouriensis, Shum. (Mo. Report II, 204.) From bed No. 4, Sciotoville, Ohio.

Rhynchonella Marshallensis, Win. (Proc. A. N. S., Phil., Sept., 1862.) From Granville, Licking county, Ohio.

CENTRONELLA? FLORA, n. sp.

Shell broadly ovate, rather rectilinear along the cardinal slopes, broadly and slightly sinnate, or not, along the ventral commissure; general form of each valve a segment of a sphere. Surface of shell very finely and sharply striate both longitudinally and concentrically.

Length, fifteen-sixteenths of an inch; breadth, fourteen-sixteenths; thickness of both valves seven-sixteenths.

This species is broader and less rostrate than *C. Allei*, Win. (Proc. A. N. S., Phil., July, 1865, p. 123,) and also less tumid around the margins, besides being much more distinctly striate.

Though I am not positive of the generic relations of this species, it appears to be congeneric with *C. Allei*. These species are both ornamented with beautiful terebratuloid punctations, and both exhibit the elongated ribbon-like muscular markings on the ventral valve which also characterize the well-determined species *C. Julia*. In one of the specimens referred (provisionally) to *C? Flora*, there is a low, but elongated median septum in the dorsal valve, from which, near the beak, proceeds, on each side, a thin horizontal, longitudinal plate, reaching half the length of the septum. In the ventral valve, the dental lamellæ are feebly developed, and, instead of reaching the inner surface of the valve, they curve toward the median line and join each other, leaving a small space between the transverse septum thus formed and the surface of the valve—being thus a kind of *shoe-lifter septum inverted*,—or, more strictly, a trough-like plate, as in *Camarophoria*, but not, like that, supported by a median vertical plate. It is worthy of consideration whether these distinctive characters are not of generic importance. The structure noticed in this specimen connects *Pentamerus* with *Terebratula*, as *Camarophoria* connects *Pentamerus* with *Rhynchonella*. I reserve the subject for further study.

From bed No. 4, Sciotoville, Ohio.

PERNOPECTEN? COOPERENSIS, Shum. sp. (Mo. Geol. Rep., Pt. ii, p. 206, pl. C, 15.) Herzer's collection, Newark, Ohio.

The single internal cast referred to this species is rather too narrow—having about the form of *P. limæformis*. It is marked by about fifteen coarse radiating grooves, with some traces of smaller intermediate ones.

Messrs. Meek and Worthen have expressed a strong suspicion (Ill. Geol. Rep. III, p. 454), that *Pernopecten limæformis* and *P? Shumardianus* are but varieties of *Avicula Cooperensis*, Shum. I embrace the opportunity to correct the impression of these authors that the surface characters of *P. limæformis* have not been seen in a perfect state of preservation. I have impressions of exteriors of this species upon fine (almost lithographic) stone, in which the most delicate characters are much more perfectly preserved than they generally are in fossils retaining the actual shell. Gutta percha restorations from these moulds are perfectly destitute of fine radiating striæ. On the contrary, they exhibit very fine, sharp and regular concentric striæ, and obsolete traces of a few straggling, irregular, discontinuous, broad folds or undulations. This species is also distinctly narrower than the others. With little doubt, its validity should be admitted.

PERNOPECTEN LIMATUS? Win. (Proc. A. N. S., P., July, 1865, p. 126.) Newark, and bed No. 4, Sciotoville, Ohio.

Like the other Ohio representatives of the species of this family, the specimens of this species are considerably larger than the Iowa types.

AVICULOPECTEN NEWARKENSIS, n. sp.

Dorso-ventral and antero-posterior diameters and length of hinge line as the numbers, 14, 10 and 7. Left valve rather convex, its cardinal slopes forming an angle of about 60°, and thus creating a sharper beak than is usual in this genus. Anterior ear somewhat inflated, with about six strong radiating striæ, finer intermediate ones, and numerous fine decussating striæ. Posterior ear a little smaller, flat, its posterior boundary nearly at right angles with the hinge. Beak scarcely exceeding the hinge. Surface marked with numerous fine, unequal, slightly wavy, delicately crenulated, radial striæ.

Dorso-ventral diameter fourteen-sixteenths of an inch; antero-posterior, ten-sixteenths; length of hinge line, seven-sixteenths.

The striæ are of the size of those in *A. tenuicostus*, Win., but they are less rigid, regular and uniform; the shell is less circular, and the umbo is more prominent.

AVICULOPECTEN CAROLI, Win. (Proc. A. N. S., Phil., Jan., 1863, p. 9.) From Newark, bed No. 4, Sciotoville, and from Granville, Ohio.

The specimens from Licking county are all right valves, and are much flatter than typical specimens of the same valve.

AVICULOPECTEN OCCIDENTALIS, Win. (Proc. A. N. S., Phil., Jan., 1863, p. 9.) From Newark, Licking county, Ohio. The largest specimen is twice the size of the Iowa types. A right valve of the same size, from Granville, shows also obsolete, irregular, radiating furrows around the margin of the cast.

SANQUINOLITES NAIADIFORMIS, n. sp.

Length two and a half times the height; laterally flattened below the umbo; dorsal and ventral margins parallel or nearly so—the ventral sometimes with a broad shallow sinus extending upwards over the valves and vanishing near the umbo; a distinct umbonal ridge flattening out near the postero-ventral angle, at which place the outline presents a rounded angulation; the postero-dorsal slope making, with the dorsum, an angle of 45°.

Length, $2\frac{3}{4}$ inches; height, one and one-sixteenth inches; thickness, half an inch.

The above description is based on a specimen from Hillsdale, Michigan. Mr. Herzer has sent a single specimen from Newark, Ohio, which agrees with this; but such is the state of preservation of lamellibranchs in this formation, that there is extreme difficulty in ascertaining their generic characters. Another specimen from Granville, Ohio, presents a still better specific accordance.

SANGUINOLITES (CYPRICARDIA?) SECURIS, n. sp.

Outline of shell sub-oval, anteriorly indented by a small lunule, over which hangs the small, incurved, approximated, sub-terminal beaks. A very prominent, sub-acute ridge runs from the beaks posteriorly and but

little below the level of the straight indented hinge line. The greatest thickness of the shell is therefore near the flattened dorsal border. From this ridge the lateral surfaces proceed with slight curvature to the ventral margin, so that the united valves present a cuneate or somewhat axe-like form.

Length, one inch; height, thirteen-sixteenths; transverse diameter, nine-sixteenths.

This species is less elongate than *Cypricardia rigida*, and has a rounded, instead of truncate posterior extremity; the umbonal ridge, also, is nearer the hinge margin.

Collected by Rev. H. Herzer, at Newark, Ohio.

SANGUINOLITES MARSHALLENSIS, Win.

Occurs in bed No. 4, Sciotoville, Ohio.

ALLORISMA (SEDGWICKIA) HANNIBALENSIS, Shum. (Mo. Rep. p. 206). Specimens from Newark, Ohio, agree better with the Burlington (Iowa) forms usually referred to this species, than with Dr. Shumard's figure of the type.

CYPRICARDIA (?) RIGIDA, W. & W. (Bos. Proc. VIII, 300.)

A single specimen from Newark, Ohio, which does not show the "second ridge" between the main umbonal angle and the hinge, and which may result from dorso-ventral compression.

LEDA BELLISTRIATA? Stephens (Am. Jour. Sci. [2] vol. XXV, p. 26.) Five specimens from dark, bituminous Shales, Tennessee, are referred to this species solely on account of external resemblances. They have the peculiar form and sharp concentric furrows of the species. They are a little over an inch in length, but do not, in this, exceed specimens from Battle Creek, Michigan,—the typical locality. At the same time, no indication of hinge-structure has been observed, and the shell seems to have been thinner than usual for the species of this family. Should further discovery demonstrate that these specimens do not belong to *Leda*, they will perhaps fall into the genus *Sedgwickia* of McCoy; but I do not consider it allowable to propose a specific name to be based on discoveries of some future investigator.

CONOCARDIUM PULCHELLUM, White & Whit. (Proc. Bos. Soc. N. H. VIII, 299.) From Newark, Ohio.

SOLEN SCALPRIFORMIS, Win. (Proc. Acad. N. S., Phil. Sep., 1862, p. 42?.) From dark, bituminous shales, Tennessee. Like other species in the same situation, the shell is thin and fragile. This probably resulted from an insufficiency of calcareous matter in the waters which precipitated the argillo-bituminous materials of the rock.

SOLEN QUADRANGULARIS, Win. (Proc. A. N. S., Phil. Jan., 1862.) A fragment from Granville, Ohio.

PLATYCERAS HERZERI, n. sp.

Shell rather large, consisting of about two coils, which enlarge rapidly near the apex, and gradually through the last half of the whorl; laterally compressed, and dorsally sub-angulated, except near the aperture; irregularly plicated longitudinally, and marked transversely by deeply waved,

lamellar striæ of growth indicating a coarsely and unequally crenate aperture.

Of this species two varieties may be recognized: (A) The typical form, differing from *P. paralium*, W. & W., in its excentric apex; (B) A form less profoundly plicated—perhaps because younger specimens. These forms I was at first inclined to regard as varieties of *P. haliotoides*, M. & W., but I believe the departures are too extreme and the mutually-concurring specimens too numerous for specific identity with the Illinois forms.

The largest specimens, when resting on the aperture, are an inch in height; the transverse diameter of the aperture is five-sixteenths of an inch, and the dorso-ventral diameter six-sixteenths.

Quite abundant at Newark, Ohio.

PLATYCERAS HALIOTOIDES, M. &. W. (Ill. Geol. Rep. 458, pl. xiv, fig. 3). From Newark, Ohio.

PLEUROTOMARIA HICKMANENSIS, Win. (Tenn. Geol. Rep).

Globose shells in an incomplete state of preservation, showing regularly convex whorls ornamented with numerous delicately raised and finely beaded revolving striæ, and a well-defined band, without distinct carina. The striæ limiting the band are not beaded, but all the others, on both sides, bear 50 to 60 granulations to the inch. The striæ are quite unequal in number and distribution, since they increase by implantation, with the growth of the shell. The base of the shell is about an inch in diameter, and seems to be perforated by a small umbilicus.

From dark, bituminous shales, Hickman county, Tennessee.

PLEUROTOMARIA VADOSA, Hall (XIII. Rep. N. Y. Regents, p. 108.) Numerous casts occur in bed No. 4, Sciotoville, Ohio, which are quite identical with casts from Michigan. Some imperfect moulds, larger than the typical forms, occur also in bed No. 5, Rockville, Ohio.

MURCHISONIA PROLIXA, W. & W. (Proc. Bos. Soc. N. H. VIII, 303.) Bed No. 4, Sciotoville, Ohio.

MURCHISONIA QUADRICINCTA, Win. (Proc. Acad. N. S., Phil. Jan. 1863, p. 19.) Bed No. 4, Sciotoville, Ohio.

BELLEROPHON CYRTOLITES, Hall. (XIII. Rep. N. Y. Reg.)

A single imperfect specimen from Granville, Ohio.

CONULARIA BYBLIS, White. (Proc. Bos. Soc. N. H., Feb. 1862, p. 22.) From dark, bituminous shales, Hickman county, Tennessee.

I feel no doubt of the identity of this species. It possesses the same small isolated eminences or granulations ranged in a line along the crests of the ridges, which characterize well preserved specimens from Burlington, Iowa. From 60 to 75 of these eminences may be counted in the space of an inch.

Dr. White does not mention these granulations; only stating, "spaces between the ridges finely crenulate." Worn specimens develop a series of transverse bars between the ridges, which undoubtedly correspond in position with the granulations seen in unworn specimens. Compare with this species, *C. Gervillei* d'Archiac et Vern., Mem. Foss. Rhenish Prov. in Trans. Geol. Soc., Lond., vol. VI, p. 351.

CONULARIA NEWBERRYI, Win. (Proc. A. N. S., Phil. July, 1865, p. 130.) From bed No. 4, Sciotoville, Ohio.

This shell was probably as large as *C. byblis*. It has the form of a quadrangular pyramid compressed in the direction of two opposite angles. It differs from *C. byblis* as follows:—Its form is much more distinctly angulated; the septa range from 17 to 44 to the inch, while in *C. byblis* they range from 56 to 128 to the inch; it bears a deep V-shaped furrow along each of the angles; within this furrow the septa are deflected abruptly toward the base of the shell, so that they meet from opposite sides at about a right angle; the septa also sweep toward the base with a gentle curve in their extension across the side of the pyramid, by which their centres are about two intervals lower than the portions in the ridge which bounds the angle-furrow. In *C. byblis* the septa-margins also trend toward the base, but they are more nearly straight from angle to centre. The septa, like those in *C. byblis* and many other species, are ornamented along their margins by delicate granulations. The species appears to have been at least three or four inches in length.

The septa toward the upper end become more direct, and I have little doubt that it was the apical portion of this species from which *C. Newberryi* was originally described.

ORTHOCERAS INDIANENSE, Hall. (XIII. Rep. N. Y. Reg.) From Newark and from bed No. 4, Sciotoville, Ohio. One of the specimens from the latter locality exhibits a broad constriction near the base of the outer chamber. From Newark are also fragments of an *Orthoceras* having an elliptic section and oblique septa.

NAUTILUS (TREMATODISCUS) TRISULCATUS, M. & W. (Proc. A. N. S., Phil., 1860, p. 470.) From bed No. 5, Rockville, Ohio.

GONIATITES MARSHALLENSIS, Win.

From Newark, Ohio. Differs from *G. Lyoni*, M. & W. (=*G. Hyas*, Hall), in having the transverse section regularly curved instead of broadest near the umbilicus; in having the first and second lateral lobes rounded instead of acuminate; in having an additional accessory lobe and saddle, and in having the dorsal lobe broader and relatively longer.

GONIATITES SHUMARDIANUS, Win. (Am. Jour. Sci. [2] XXXIII, 364, May, 1862.) From Newark, Ohio.

The specimens of this species, though fragmentary, exhibit nearly all the specific characters.

To the description of *G. Shumardianus* originally given, may be added the following characters, drawn from the Newark specimens: Accessory lobe concealed, same form as the lateral one, but only one-third its size, separated by a parallel-sided, circularly terminated saddle from a narrow, elongated, parallel-sided ventral lobe.

As the three species, *G. Allei*, *Shumardianus* and *propinquus*, are closely related in general aspect, their diagnostic characters may be here given in stronger contrast.

G. Allei wants the dorsal lobe—unless we regard the two first-lateral together with the dorsal saddle, as a bifid dorsal lobe—and has a closed umbilicus.

G. Shumardianus has a simple dorsal lobe and an open umbilicus.

G. propinquus has a shorter and narrower dorsal lobe than *G. Shumardianus*, with a closed umbilicus.

GONIATITES OHIENSIS, n. sp.

Compressed-globoid, deeply and broadly umbilicate. Dorsum rounded, sides considerably and somewhat obliquely flattened, so as to give the widest transverse section near the borders of the umbilicus, this diameter being to the dorso-ventral as 4 to 3. Dorsal lobe oblong, parallel-sided, obtuse, separated, by a broader and longer, obtusely rounded dorsal saddle, from a subclavate, acute lateral lobe, which reaches half its length behind the dorsal one. This lobe is followed by a very broad shallow saddle having its apex turned obliquely toward the dorsum. Second lateral lobe small, equilaterally triangular, situated on the brink of the umbilicus.

Greatest transverse diameter, fifteen-sixteenths of an inch; dorso-ventral diameter, twelve-sixteenths; diameter of umbilicus, seven-sixteenths.

Differs from *G. Shumardianus* in its parallel-sided, obtuse dorsal, and linguiform, acuminate first lateral lobe; also, in the oblique position of the lateral saddle. There is no species likely to be confounded with it unless it be *G. Andrewsi*, which has the sides more convex, and differs also in its acuminate-clavate dorsal lobe.

From Newark, Ohio. Collected by Rev. H. Herzer.

GONIATITES ANDREWSI, n. sp.

Compressed-globoid; deeply, broadly and abruptly umbilicate. Rounded on the sides, and more rapidly on the dorsum; greatest width close to the umbilicus; transverse diameter to the dorso-ventral as 4 to 3. Dorsal lobe long, clavate, acuminate, separated by a sub-clavate broadly rounded saddle from the first lateral lobe, which is also clavate-acuminate, but a little broader than the dorsal, and a trifle shorter. This is followed by a very broad, obliquely situated saddle, having its dorsal side concave in the middle, and its umbilical side gently convex. The whorls are marked each by about four constrictions. In one specimen, which seems to preserve a portion of the shell, it is seen to present somewhat uniform, closely-set, transverse wrinkles in the region near the umbilicus. Casts of the umbilicus retain the impression of every whorl to the very apex, and show that this species attained seven or eight volutions, the later of which increased in transverse diameter more rapidly than the earlier.

From Newark, Ohio. Collected by Rev. H. Herzer.

CYTHERE CRASSIMARGINATA, Win. (Proc. A. N. S., Phil., Sep., 1862.) From bed No. 5, Rockville, Ohio. Some of the specimens attain twice the dimensions of the types of the species.

PHILLIPSIA MISSOURIENSIS, Shum. sp.

From Newark, Ohio. Collected by Rev. H. Herzer.

All the known characters of the species are exhibited, except the granulations of the surface, which the state of preservation of the specimens renders it impossible to detect.

PHILLIPSIA TENNESSEENSIS, Win. (Tenn. Geol. Rep. p. 445.)

Glabella prominent, indented by a small, round, depressed, postero-lateral lobe, and isolated by a deep occipital furrow from a prominent

occipital ring, which extends, narrowing in width and curving backwards, entirely across the border, fading out toward the short, acute genal angle. Border concave, bounded by a prominent ridge, outside of which is a linear groove limited peripherally by a sharply elevated, delicate, linear margin. Surface of glabella, accessory lobe and neck-ring covered with fine unequal granulations; a row of granules along the ridge of the border.

Pygidium broadly rounded, nearly twice as broad as long, apparently depressed; axis with 8 or 9 rings, tapering to the posterior end, which is somewhat abruptly rounded off one-tenth of an inch from the extremity of the pygidium; lateral lobes with 8 or 9 segments becoming obscure posteriorly. Border about one-sixteenth of an inch broad, marked on the under side by nine rigid, sharply impressed parallel striæ. Exterior of the crest very finely and obscurely granulated. Length, about three-eighths of an inch; breadth, five-eighths.

Other characters of this species are unknown. It seems to approach nearest to *P. articulata*, Hall sp. (XV. Rep. N. Y. Regents, p. 107.) From the Waverly of Ohio; but is destitute of the anterior and middle furrows of the glabella. Neither does the description of that species give the surface characters, though comparison is made with *Proetus Missouriensis*, Shum., from the lithograpic limestone of Missouri, which is a granulated species. It differs from *Proetus* (*Phillipsia*) *ellipticus*, M. & W. (Ill. Geol. Rep. III, 460), from the Kinderhook group, in the characters of the cephalic border, in the absence of glabellar furrows, and in the border of the pygidium.

From calcareo-argillaceous beds, of yellowish brown color, and from calcareo silicious shales, Hickman and Maury counties, Tennessee.

PHILLIPSIA DORIS, Hall sp. (XIII. Rep. N. Y. Regents, p. 112, and Winchell, Phil. Proc., July, 1865, p. 133.)

Several small pygidia occur in the collection from bed No. 5, Rockville, Ohio.

PLEURODICTYUM PROBLEMATICUM, Goldf.

Well preserved specimens occur at Newark, Ohio. Collected by Rev. H. Herzer.

MURCHISONIA sp?

A fragment nearly three inches long, consisting of four whorls—probably about one or two whorls wanting at the apex and an unknown portion from the other end. The whorls are very oblique, the deeply impressed suture making an angle of 40° or 45° with the axis of the shell. The apical angle of the spire was not more than 18° to 25°. It most nearly resembles *M. quadricincta*, Win., but it has quite a different expression, besides being much larger and having more oblique whorls.

From near Shafer's, Pennsylvania.

From Newark is a *Sigillaria*, and a *Myalina* too imperfect for identification. Two or three species of *Fenestellidæ* occur at Sciotoville, Rockville, and in Licking county. Three species of crinoidal stems exist in Prof. Andrews' collection, from Newark, Granville and Sciotoville. A *Sanguinolaria* occurs at Sciotoville; and at Granville and Sciotoville is an interesting compound coral with minute tubes, whose specific details are well exhibited, though its generic position is undetermined.

ON SOME ETHEOSTOMINE PERCH FROM TENNESSEE AND NORTH CAROLINA.

By E. D. Cope.

ETHEOSTOMA, Raf.

The species of this genus are nearly allied to each other. I gave a synopsis of the three with which I was acquainted in 1866 (Trans. Amer. Philos. Soc., p. 400), and now add characters of two other species. They are to be compared with the E. peltatum, Stauffer, and E. maculatum, Girard.

A Scales 7-8—52-5—8-12.

I. Head 4.5 to base of tail; cheeks scaled.

R. D. XIII I.12 A II.8 Muzzle obtuse, wide; maxillary to line of pupil; maxillary teeth nearly equal: a series of separate spots on the sides behind scapula. E. NEVISENSE.

II. Head 3.6 to 4 times to origin caudal; cheeks naked.

R. D. XI–XII.12–13 A II.9 Muzzle compressed acute; maxillary to line of pupil; a larger series of maxillary teeth exteriorly; a series of eight spots on the sides connected by a band; eye near four times in head. E.? MACULATUM, var.

"R. D. XIV.14 A II.10 Maxillary to line of orbit." Girard. E. MACULATUM.

R. D. XIII.13 A.I.10 Maxillary to line of pupil. E. PELTATUM.

ETHEOSTOMA NEVISENSE, Cope.

Sp. nov.

This is an elongate fish, with muzzle obtuse in profile, as well as wide, viewed from above; cheek, operculum and median dorsal line scaled; ventral line without spinous scales, one only present in the symphysis of the "coracoids." Isthmus very narrow. Anal fin with base a little shorter than second dorsal; the species may really be a Poecilichthys. Scales 8—53—11. First dorsal moderately elevated; second peculiar in spinous ray, well separated from the first dorsal. Caudal fin slightly forked.

Ground color above yellowish, crossed by nine dark chestnut quadrate spots on the median line, which are wider than their interspaces, and are connected at their ends by an undulate chestnut band. Below the latter a similar longitudinal band on the anterior half of the body. Six quadrate black spots on the sides, with a small spot between each. A dark band from end of muzzle to scapula; below it on operculum, a silver spot. A black bar below eye. Belly white. Caudal and second dorsal distinctly, pectoral and ventral, faintly black barred. A series of black spots along middle of first dorsal.

Length 3 in. 25 lin. Diameter orbit 2.2 lines. Depth at first ray second dorsal 4.8 lines; at occipital region 4 lines.

This species, though near the next in general appearance, is very different in details of structure, and I am not sure that it may not be referable to the genus Poecilichthys. It is based on one specimen which was taken

in boisterous water at the falls of the Neuse River, 8 miles east of Raleigh, North Carolina.

ETHEOSTOMA MACULATUM, Girard.

Putnam Bull. Mus. Compar. Zool. No. I *Hadropterus maculatus*, Girard, Proc Acad. Nat. Sci., Phil. 1859, 100.

My specimens differ from that described by Girard as expressed in the table above, and they may be distinct. They differ among themselves thus: In two specimens the radii are DXI.13; in two XII.13, and in one XII.12. The type of E. peltatum, Stauff., differs also; its anal radii should be expressed I.10, not II.9 as heretofore given. I am, therefore, not sure whether it belongs to this genus.

Several specimens from the upper waters of the Catawba River.

ETHEOSTOMA BLENNIOIDES, Raf.

From the headwaters of the Cumberland River, Campbell co., Tenn.

COTTOGASTER, Putn.

COTTOGASTER AURANTIACUS, Cope.

Jour. Acad. Nat. Sciences, Philada. 1868, 211.

One specimen from the French Broad River in Madison co., N. Ca., measuring 4 inches, 8 lines in length, more than twice the size of the types, and larger than any species of the group excepting Percina caprodes. Colors, bright yellow and black in life.

PERCINA, Hald.

In this genus the median line of the abdomen and thorax is protected by a series of enlarged spinous scales, as in Etheostoma. This is no doubt a protection to the belly from the rocky and stony bottoms which the animal haunts.

PERCINA CAPRODES, Raf.

From the South fork of the Cumberland River, Campbell co., Tenn.

POECILICHTHYS, Agassiz.

I. Branchiostegal membranes distinct throughout their length.

Slender; head attenuated, muzzle not decurved; depth 5.25 lines in length to base caudal; first dorsal low, elongate RXII (XIII); scales small l. l. 55–62. Black with scattered crimson spots; fins crimson not margined; P. SANGUIFLUUS.

Stout, head short, muzzle abruptly decurved from orbits, latter large, scarcely four times in head; dorsal line plane, depth 4.5 times in length; first dorsal elevated R. X (XI–XII); scales larger l. l. 50–54. Black with crimson spots in rows of three and four; fins crimson, yellow and black margined. P. CAMURUS.

Stout, head acuminate, muzzle not much decurved, dorsal line much arched, depth 4.5 in length; first dorsal elevated (X–XI) XII; scales largest l. l. 43–47; eye small, nearly five lines in length of head. Light, with narrow dark lines enclosing spaced quadrate red-brown spots; below orange; head brown lined, fins crimson bordered. P. RUFILINEATUS.

Like the last but D.XV, scales smaller l. l. 53, and dorsal line not

arched. Light, with dark olive vertical cross-bars, and a few scattered crimson spots; red spots on middle first dorsal, other fins unspotted.

P. VULNERATUS.

II. Branchiostegal membranes united across thoracic region.

Slender, cylindric; muzzle acuminate depressed; orbit 4.5 times in head; depth 6.5 in length, D.VII small; P. very long, reaching the anal; naked below anteriorly; cheeks and operculum scaled; transparent in life, with dorsal and lateral spots. P. VITREUS.

POECILICHTHYS ZONALIS, Cope.

Journ. Acad. Nat. Sci., 1868, p. 212, tab. 24, f. 1.

The vertical bands which are represented as brown in the above figure, are a beautiful turquoise blue in life.

From a tributary of the French Broad River, Madison co., N. Ca.

POECILICHTHYS FLABELLATUS, Raf.

Putnam Bull. Mus. Comp. Zool. 1. (*Catonotus*) Cope, l. c. 213.

A very marked variety, perhaps species, represented by three specimens from the upper waters of the Catawba River, N. Ca. Scales much larger than in the types, 6—42–4—9–10; in the only adult there are but four vertical cross-bars below the dorsal fins, (six to eight in the usual variety) and the fin formula is much reduced, i. e. DVI–12 A II.6. In a younger specimen the D.VII–12 A II.8, and in a third, D.VIII–12 A II.7.6. The dorsal and lateral spots are more numerous than in the adult. Head in the latter 3.5 times in length to caudal. In other respects this form is like the type, except that in life the colors are paler.

POECILICHTHYS VITREUS, Cope.

Spec. nov.

This species is very unlike the others of the genus, having the cylindric form of Percina and Pleurolepis; it further resembles Pleurolepis pellucidus in the transparency of its muscles, but is to be referred to another genus on account of the reduction of its anal fin, and its complete scutellation.

The head is remarkably acuminate, the profile gradually descending and the under jaw received within the upper; the mouth is nearly terminal, and the extremity of the maxillary bone reaches barely to the line of the anterior margin of the orbit. Both cheeks and operculum are covered with large pectinated scales, the former as far as the preopercular bone. Opercular spine rudimental, flat, as in some individuals of P. flabellatus. The orbit is relatively small, its diameter being less than the length of the muzzle in advance of it, and a half less than one-fourth the length of the head. Depth of head at deepest point, one-half its length; its length 4.5 times in length of body to basis of caudal. The fins are not largely developed, except the pectoral, which is very long and acuminate, reaching the line of the vent. Br. VI. D. VII–14. A II.9. Ventrals cuneiform, a little over half the length of the pectorals. Caudal nearly equal or slightly concave. Scales 6–56—7, counted from the anterior ray of the second dorsal to the vent. On the anterior half of the dor-

sal region they are not continuously developed and are cycloid; a large part of the most anterior portion is naked. On the anterior fourth the ventral surface the scales are cycloid, not imbricate, and below the pectoral fins entirely absent. Other scales ctenoid. Caudal peduncle not deep nor constricted.

	Lines.
Total length	24
Of caudal fin	3.6
Of basis first dorsal	3.4
Of pectoral	8.4
Of muzzle,	1.5
Width of body opposite first dorsal	2.3

In life this species is nearly colorless, and the myocommata and other muscles are transparent. The viscera are perfectly visible, and in the specimen taken, the two ovaries with all the eggs in an advanced stage of development were seen with entire distinctness. There are seven imperfectly formed pale green blotches on the dorsal line, and a series of eight or nine on the lateral line of a linear form, arranged longitudinally, and of the same greenish tint. A few blackish specks between these, and below the eye; a large spot on operculum and line on canthus rostralis. Caudal fin faintly barred; other fins and lower surfaces immaculate; ventrals with white edge within.

One specimen taken in Walnut Creek, a tributary of the Neuse River, in Wake co., N. Carolina, late in November.

From the advanced condition of the eggs they must be excluded either in the Winter, or a very early Spring, for even that mild latitude. In its transparency this fish resembles the Pleurolepis pellucidus, Agass. When first taken its scales are entirely invisible, and it requires coagulation in alcohol before they can be readily detected.

The vomerine teeth of this fish are very few in number, and the maxillaries and mandibulars are very abruptly incurved.

Poecilichthys sanguifluus, Cope.

Species nova.

Of the same form as the P. flabellatus; i. e. elongate, with dorsal line not elevated, and very deep caudal peduncle. Head flat acuminate, the front descending very gradually, the mandible as gradually rising to its extremity. Orbit rather large, diameter equal to that of muzzle, and one-fourth length of head. Opercular spine well developed, the operculum scaled, cheek naked. End of maxillary marking line of pupil. Teeth of outer rows larger. Length head without spine, one-fourth total to basis caudal. Fins generally, especially the caudal, short; latter slightly rounded. First dorsal much elongate; first anal spine very large. In four specimens the fin and scale formulae vary as follows: 1st, Br VI. D.XII–12. A II–8; 2nd, D.XII–12. A II–9; 3rd, XII–13. A II.9; 4th, DXIII.12 A II.9. Scales 9—54-62—10.

	Lines.
Total length	31
Of head	7
Of caudal fin	4
Pectoral	5.6
Basis first dorsal	8.4
Depth at occiput	4

The coloration of this fish in life is very elegant, as follows: above black, shading to dark olive below, and with a narrow, repand, leather colored dorsal band; throat turquoise blue; sides and dorsal region marked with small circular spots of bright crimson irregularly disposed, and in considerable number. First dorsal uncolored, with a black spot at base anteriorly, and a dark shade through the middle. Second dorsal blood red, without border; caudal with two large crimson spots confluent on the middle line of the tail at the base, no border; pectoral and ventral not red bordered. A female has the 2D. C. and A. black barred, and not crimson.

This lovely species is common in the head waters of the South Fork Cumberland, in Tennessee.

POECILICHTHYS CAMURUS, Cope.

Species nova.

This species is nearly allied to the last. It is distinguished by many characters, of which some have been pointed out in the synoptic table. It is a stout, deep-bodied fish, not a slender one, and with the head as deep as the body and suddenly decurved from the orbit to the muzzle. The first dorsal is higher and shorter, though occasionally with the same number of radii. The scales are larger. In life the coloration though of the same type, is constantly different, and the females differ from the males as they do in the preceding and following species.

Maxillary bone opposite line of pupil; cheek extended, naked; operculum scaled, with a strong spine. Fins better developed than in P. sanguifluus. Formulae in five specimens; first, Br. VI D. X–13 A. II.8; 2nd, D X–13 A II.9; 3rd, D. XI–13, A. II. 8; 4th, XI–14 A II. 8; 5th, DXII–12. A II.8. Scales 7—52–4—8.

	Lines.
Total length	31
Of head	7
Of caudal fin	4
Of pectoral	6.2
Basis of first dorsal	7.2
Depth of occiput	5
At middle first dorsal	5.2

In life the color is blackish to very dark olive, with an obscure dorsal band of a paler shade; belly paler. Sides abundantly sprinkled with crimson spots, which are smaller than in the P. sanguifluus, and differ further in being arranged in short longitudinal series of threes and fours. First dorsal with a black spot at base in front, and a crimson one on the margin between the first and second radii. Second dorsal, caudal and anal, crim-

son bordered with yellow, which again is bordered with black on the edge of the fin; the crimson is deepest just inside the yellow margin in all three. The pectoral and ventral fins have a broad red margin. Thoracic region turquoise.

This species, like the last, occurs abundantly in the head waters of the Cumberland River, in Tennessee, in company with P. coeruleus, Hyostoma, and Etheostoma blennioides.

The females of the first two present a different appearance, in their olive colors, with dark vertical bars, and absence of red spots. All of the above species lie on the bottom, frequently beneath stones, with the head only projecting on the lookout for prey. Ordinarily they lie motionless, except occasionally inclining their position and exhibiting their gorgeous colors. The effect of these is heightened by the crystal clearness of the waters of the mountain streams, which reflect as well the beauty of a southern sky, and the noble trees and flowering shrubs that border them in the rich wilderness of the Cumberland range. Few more attractive spots to the naturalist can be found, and among its natural treasures, these peculiar little fishes are among the most curious. All the fishes of this group can turn the head from side to side, and they frequently lie in a curved position, or partially on one side of the body.

It is possible that one of the two species above described may be the P. maculatus (*Etheostoma*, Kirtl. *Nothonotus*, Agass), but which, I have in vain essayed to discover. It may be neither. The description of form and colors apply best to the P. sanguifluus, but its dorsal fins are those of P. camurus. If the statements "operculum double spined" and "anal I-7" are correct, it is manifestly different, but I suspect they are errors.

The caudal peduncle is represented to be much more slender than in our specimens, but this may also be inexact.

POECILICHTHYS VULNERATUS, Cope.

Species nova.

General form fusiform; body stout, depth 4.5 times in length to basis caudal, peduncle very stout; dorsal line scarcely arched. Top of head gently and regularly curved to end of muzzle, much as in P. sanguifluus. Orbit four times in length of head to basis of opercular spine, equal length of muzzle, cheek smooth, operculum scaled, with well developed spine. Fin rays DXIV. 13. A II 8. First dorsal large, not low, caudal truncate rounded, anal small. Scales small 8—53—9.

	Lines.
Total length	25
Caudal fin	3.8
Base first dorsal	7
Of head	5.6
Depth at occiput	3.4
At posterior margin first dorsal	4.6

Color in life, light olive, with about eight vertical dark olive bars on the side, which are interrupted above the lateral line. A few irregular crimson dots on the sides. Fins uniform transparent except the first dorsal

and caudal; the former has a median series of red spots; the latter is pale orange, with a black margin; no fins cross-barred; D. 2, with a black margin.

From Warm Springs Creek, a tributary of the French Broad River, Madison co., N. Carolina.

This species is in general proportions intermediate between the P. rufilineatus and P. sanguifluus, but is in some points of coloration like the P. camurus. That it is not the female of P. rufilineatus is clear, though its size is similar to the smaller individuals of the latter. The coloration alone would indicate that it was a male.

POECILICHTHYS RUFILINEATUS, Cope.

Species nova.

Stout, the dorsal line elevated and descending regularly from the base of the first dorsal ray to the end of the muzzle. Muzzle short, regularly conic, about as long as the diameter of the orbit; latter smaller than in the other species, 4.5 times in head. Maxillary to line of pupil. Cheeks smooth, operculum scaly, with strong spine. Dorsal well developed; caudal peduncle deep, caudal fin small truncate. Scales larger than in the species above described; 6—41–7—7–8. Rays; 1st D. X. 12. A II.8. 2nd, D. XI. 12 A. II.8; 3rd, XI. 12, II.9; 4th, XI. 13, II.8; 5th and 8th, XII. 12 II.8; 6th, XII. 13, II.8; 7th, XII. 11, II.8.

	Lines.
Length of the largest	32.5
Of a second	31
Of head of latter	6.4
Of caudal fin	4.4
Of pectoral fin	6.4
Basis of first dorsal	9.3
Depth at occiput	2.3
At middle first dorsal	5.8

In males the color in life is pale olive for a ground above, with numerous narrow longitudinal lines, each on the adjacent margins of the two rows of scales. These include a number of quadrate spots of a mahogany or brick red color, which alternate with each other, but are not regular in position or number. Pectoral region turquoise blue, belly bright red orange. Head with two longitudinal mahogany-colored bands, and a spot of the same below the eye. Five red spots on each side of the head, on operculum, preoperculum, suboperculum, and on each lip. Pectoral, ventral, first and second dorsal and anal broadly crimson bordered, the last with a narrow black margin. Caudal fin brownish, broadly vermillion bordered, with a narrow black edging; two orange areas at the base. Anal vermillion with yellow base and black margin on posterior half.

Females are more olive, and the spots are partially confluent into vertical bars;—D. 2, C., and A. black barred. A male forms a variety with the quadrate spots obsolete and the D. 2, C., and A. with yellow margin inside the black.

This fish was abundantly seen in Warm Springs Creek, which flows into

the French Broad River, in Madison co., N. Ca. Eight specimens were taken with some difficulty. The beauty of the species is scarcely exceeded by any of the preceding; if not so elegant, a male in summer attire is more gaudy. They inhabit shallow, swift waters with rocky bottoms, and take refuge under stones with great rapidity, whence much patience is required to draw them.

The conic form of the head, small orbit and elevated dorsal region, characterize this species among other points apart from coloration.

POECILICHTHYS COERULEUS, Storer.

From the South Fork of the Cumberland, Tenn.

BOLEOSOMA, Dekay.

Second dorsal larger than anal fin; vomerine teeth present; no series of abdominal plates; two osseous anal radii; scales well developed; premaxillary projectile, the labral dermal fold extended across the muzzle.

This genus is identical with Poecilichthys, excepting in the completion of the labral fold, which in the latter genus ceases on each side of the muzzle. The simple anal, formerly assigned as its character, I find to belong to one or two species which are so nearly allied to the type as to preclude their generic separation.

Synopsis of Species:

I. Anal radii, II.

Caudal peduncle thick, not contracted; cheek scaleless; branchiostegal membranes nearly distinct, spine rudimental; tail rounded; muzzle blackish. B. EFFULGENS.

Caudal peduncle contracted, dorsal line not elevated; cheek scaleless; branchiostegal membranes well connected, spine developed; tail truncate; crown and muzzle closely brown spotted above. B. MACULATICEPS.

II. Anal radii, I.

Caudal peduncle contracted, dorsal line not elevated; cheek scaled; branchiostegal rays well connected, spine strong; tail truncate; crown and muzzle unicolor. B. OLMSTEDI.

Caudal peduncle contracted, dorsal line not elevated; cheek smooth; D. 2 with 11–12 radii only; branchiostegal membranes connected, tail truncate; back and top of head closely speckled with black. B. BREVIPINNE.

III. Anal osseous ray wanting.

Caudal peduncle contracted, dorsal line arched from the nape; cheek ? naked; branchiostegal rays entirely distinct, spine well developed; tail truncate. B. AESOPUS.

The preceding definitions apply to considerable numbers of individuals from remote localities; these may be species, for the range of variation is very considerable, and such as is to be found nowhere else in a single species. Should they be found to present intermediate forms in regions not yet explored, they may be regarded as races, and as such, worthy of note.

BOLEOSOMA EFFULGENS, Girard.

Arlina effulgens, Girard, Proc. Ac. Nat. Sci., Phil., 1859, 64.

Char. Muzzle abruptly decurved, body elongate, slender; scales large. Fins very much developed, elevated and prolonged D. IX. 13. A II. 8. Cheek and pectoral region smooth, operculum scaled, branchiostegal membranes slightly connected. Muzzle and fins black.

Description. The mouth is horizontal, the premaxillary border below the lower margin of the orbit; maxillary to pupil. Dorsal line a little elevated above the occiput, greatest depth 6.25 times in length to origin caudal; length of head 4.2 in some (spine omitted). Opercular spine weak; orbit 3.75 times in head, equal muzzle. Scales 5—40—6. Fins all elongate; V I.6, cuneiform, reaching the anal; P. 11, narrow, reaching beyond the base of the anal. Anal spines weak, caudal very much rounded.

	Lines.
Total length	28.3
Of caudal fin	5
Of head	6
Of basis first dorsal	5.3
Of pectoral	6
Depth of first dorsal	6
Of second	3.7
Of head at occiput	3.2
Of body at middle first dorsal	4

The color of three specimens in alcohol is brown with traces of nine spots on the side. Muzzle, chin and spot below the eye black. Fins black, the second dorsal and caudal with whitish bars and specks.

Three specimens were taken in a tributary of Deep River, Guilford co., N. Ca., by my friend, Samuel C. Collins, Principal of the boarding school at New Garden, N. Ca., and kindly sent me for determination.

BOLEOSOMA MACULATICEPS, Cope.

Sp. nov.

R. D IX. 13 A II. 8. Head four times to basis of caudal fin; depth at middle of first dorsal 6.5 times in same. Scales 5—41—10. Fins largely developed. Orbit 3.75 times in head; opercular spine moderate.

Pale yellowish, with ill-defined series of dorsal and lateral spots and many speckles between. Top of the nape, head and muzzle marked with large brown spots. All the fins black barred.

	Lines.
Length	26.8
Pectoral fin	6
Median depth	3

This species is near the B. olmstedi, and may be only a variety. Its clean cheek and double anal spines are characteristic, as well the markings of the head. Common in the upper waters of the Catawba River, N. Carolina.

BOLEOSOMA OLMSTEDI, Storer,

et acctorum.

Not seen by me in Tennessee or North Carolina. The adult males of

this species, as I have observed in Pennsylvania, are much larger, and more darkly colored, especially about the head, than the females.

BOLEOSOMA BREVIPINNE, Cope.

B. olmstedi brevipinne, Cope, Journ. Ac. Nat. Sci., 1868, 214.

The thick punctation of the dorsal region and nape, and crown and muzzle, are color peculiarities of this form. The cheek is smooth. In B. olmstedi it is scaled, though in badly preserved specimens they are occasionally rubbed off.

Many specimens from tributaries of the Ohio, i. e. the Kiskiminitas and Miami.

BOLEOSOMA AESOPUS, Cope.

Spec. nov.

The dorsal line descends regularly from the base of the first dorsal fin to between the orbits, and then curves more abruptly to the mouth. Mouth terminal; eye four times in head, once in advance of its front rim. The dorsal line descends from the first dorsal fin, to a somewhat contracted caudal peduncle. Dorsal fins much elevated, VII–14. Pectorals a little elongate, not reaching vent, but little exceeding the very moderate ventrals. A. 0.–10. Scales 5—47—8. Color light brown with six small dark dorsal spots, and ten similar small spots on the lateral line. A black bar round muzzle, and one below eye.

	Lines.
Total length	26.6
Of tail	4.3
Of pectoral fin	5.2
Depth at first dorsal	4.6
At nape	3.4
Of caudal peduncle	2.3

The form of this fish is rather that of a Poecilichthys, while the absence of spinous anal ray is peculiar to the present species. From the number of rays, 10, in the anal, it is probable that the missing spinous ray is represented by the first cartilaginous ray, and is not wanting. In general it is so near to the B. olmstedi, as not to be removed from the genus.

Found in the Loyalsoc Creek, in the Allegheny region, in Lycoming co., Penna., by Aubrey H. Smith, of Philada.

HYOSTOMA, Agass.

Cope, Jour. Ac. Nat. Sci., Phil., 1868, 214.

HYOSTOMA CYMATOGRAMMUM, Abbott.

From the head of the Cumberland, Tenn., and French Broad River, N. Ca. I consider *H. blennioperca*, Cope, l. c., as only a variation of this species.

HYOSTOMA SIMOTERUM, Cope.

Jour. Ac. Nat. Sci., Phil., 1868, 215.

From a tributary of the Clinch River, Tenn.

ON SOME REPTILIA OF THE CRETACEOUS FORMATION OF THE UNITED STATES.

POLYDECTES, Cope.

This genus is indicated by one, perhaps more teeth, which resembles in some respects those of the Crocodilian genus Thecachampsa. Crown of dense concentric dentinal layers, with small pulp cavity. Enamel with two prominent ridges separating inner from outer aspects, but approximated on the inner face, which thus included, is but one-third the circumference of the tooth. Ridges extending from tip to near base of crown, with a sulcus along the inner side of each. Crown acuminate, a little swollen at the base and above the middle. Section circular.

POLYDECTES BITURGIDUS, Cope.

Crown a slender cone slightly curved near the base. Middle portion constricted, its surface marked with narrow obscure facets. On the inner face, a shallow groove within each of the bounding sulci, the two separated by an indistinct groove. The enamel is smooth and worn, and leaves no traces of other sculpture.

	Lines.
Length of crown	30
Diameter at base of do	10
" middle	6.
" above do	6.5

From the marl pits of James King, Sampson co., N. Ca. Discovered by Prof. W. C. Kerr, Director of the Geological Survey of North Carolina.

LIODON CONGROPS, Cope.

Spec. nov.

This species is indicated by a posterior cervical vertebra which presents so many characters, as to render its exclusion from the present work scarcely proper. In size it bears some relation to the *Mosasaurus minor*, Gibbes, but is still smaller, and is separated at once by the round instead of depressed articular faces.

The posterior articular face is the round one; the anterior is slightly depressed; and opposite the diapophyses and neural canal slightly flattened, so as to give a slightly trilateral superior outline to the cup. It is not excavated above as in the species of Clidastes. The hypapophysis is broken, but its base is unusually long and wide. The infero-anterior limb of the short diapophysis descends to the edge of the cup, considerably below its middle. The space it encloses with its superior ridge which extends into the anterior zygapophysis, is reticulate striate. The whole surface below is minutely striate; the striæ become coarse as it approaches the ball. The latter is surrounded by a groove, and its margin projects acutely beyond the adjacent surface of the centrum. The latter is much contracted behind the ball, and the faces below the diapophyses are concave. Bases of neurapophysis striate. Neural arch broken away above. Neural caudal with an epapophysial ridge.

	Lines.
Length centrum with ball	20.8
" " to ball	18
" " " hypapophysis	5.8
Width base hypapophysis	5.5
Depth ball	10.4
Width "	11
" cup	12.6
Depth "	11.
Length base neurapophysis	12.

In profile the ball has a very slight obliquity looking upwards. From the Rotten Limestone of Alabama, discovered by E. R. Showalter, M. D.

LIODON VALIDUS, Cope.

Macrosaurus validus, Cope., Proc. Boston, 1869. *Nectoportheus validus*, Cope, Proc. A. N. S., Phil., 1868, p. 181; Leidy, Cretac. Rep. 74–75, Tab. VII, 19–20, III 1 2.

This species is represented by two cervical and four dorsal vertebrae of one individual, and a large dorsal of another, in the museum of the Academy; the former associated with numerous fragments—including part of an os quadratum, from L. T. Germain, Burlington co., N. J. Two dorsal vertebrae of a large individual in the museum of Rutger's College, several vertebrae with broken quadrate and other bones and teeth in my private collection, from near Barnesboro, Gloucester co., N. J., and a number of vertebrae in the collection of Prof. Marsh, of Yale College, further establish its character.

The *quadrate bone* is highly peculiar as above pointed out. The posterior descending hook of the proximal extremity is quite short, and is marked by an obtuse ridge which passes forwards and disappears immediately above the pit alongside the meatus. What especially characterizes this species and genus, and allies it to Clidastes, is the presence of a strong longitudinal angular ridge, which extends from the usual external angle of the proximal extremity, (which becomes here a process,) separating the outer aspect of the quadratum into two entirely distinct planes; one that of the meatus, the other that of the ala.

Two separate *opisthotic bones* accompany these remains, which were mixed up with those of the M. depressus. The vertebrae of the two species were easily separated. The quadrate bone also was identified by one accompanying the vertebrae of M. validus, in my own collection. I could not so readily assign the opisthotics to the proper species. I have assigned them here, because their glenoid cavities apply much more readily to the quadrate bone of the L. validus than of the M. depressus. As compared with the same bones of two Mosasaurus dekayi, they present three marked characteristics. First, they are relatively much shorter; second, the distal anterior process which fits within the squamosal is much more prolonged; third, the inferior of the two faces to which the squamosal is applied, is a continuation of the general inferior plane of the bone; in M.

mitchillii it is a different plane, like a rabbet. It may be added, that the glenoid cavity is narrower and deeper.

Four teeth from Barnesboro, indicate marked characters. They are much compressed as in L. mitchillii, and the posterior cutting edge is well developed and forms a narrowed extremity of an elliptic section. The anterior ridge less developed. In three crowns there is no trace of the unequal division by these edges, as in Mosasaurus sp. One probably from the premaxilla is more abruptly recurved than the others, with base rather expanded inwards. The distinguishing character of these teeth, which separates it from L. mitchillii, is the abundant longitudinal fluting, and striation of the enamel. The grooves are deeper and shallower, coarser at the base; the striæ are fine, continuous and rugose. These are not seen in L. mitchillii. The general form of the crown is short, broad at the base and well curved posteriorly and inwards.

	Lines.
Elevation of crown and pedestal	21
" " " alone	16
Antero-posterior diameter do. at base	12

The lateral element of the *atlas* is represented from the inner side in Fig. No. 3. The anterior termination of the inferior ala, and the articular face for the centrum, are as in M. mitchillii. The inner articular face is divided by a vertical depression; the posterior, or that meeting the odontoid process, is quite prominent and distinct. The anterior facet for the occipital condyle, is transversely divided by a depression.

The form of the *cervical vertebrae* is so much like that of the Mosasaurus dekayi, as to be readily taken for those of a small example of that species. The first dorsals, or those without hypapophysis, are more elongate than in the latter, and the body is more contracted, so that the ball presents a projecting rim all round. This is readily knocked off in the rough handling the specimens usually receive. The cup is also proportionately expanded. *Posterior dorsals* where the diapophyses issue half from the centrum, have the latter slightly depressed; where the diapophysis comes three-fourths from the body, the articular faces are a broad transverse ovate, well expanded on the margins, below which the surface is slightly striate. In the longer or anterior dorsals, the rudiment of zygosphen and zygantrum is well marked.

Unfortunately, no caudal vertebrae of this species have been preserved, —so that I do not know their form. The posterior dorsals are so much more depressed than in Liodon laevis that future discovery may justify the generic separation of the genus Nectoportheus which I originally applied to this animal.

For the largest measurements I refer to Dr. Leidy's Essay on Cretaceous Reptiles, where the description of the large specimens of Macrosaurus laevis belong to the present species, and have served in part as my types.

The following are the proportions of the smaller individual, from L. T. Germain:

	In.	Lines.
Length of centrum cervical (with ball)		34
Depth ball of same		18.5
Width " "		21
Length anterior dorsal		34
Width cup		24
Proximal width outer face quadratum		28
Length quadratum to lower edge pit		20
" opisthotic (see description)	3	4
" outer margin do	3	4

This was a large and powerful reptile, and probably more elongate in proportion to its bulk than the Mosasaurus, well deserving the name *Macrosaurus*, which Owen has applied to an ally.

From the upper Greensand Bed of the New Jersey Cretaceous.

THECACHAMPSA, Cope.

The species of this genus have long simple hypapophyses. In "Synopsis Extinct Batrachia and Reptilia N. A.," p. 63, the question as to the presence or absence of truncate or split hypapophyses as in Holops, etc., was left undecided.

TAPHROSPHYS MOLOPS, Cope.

In a specimen of this species which I found in place in the bottom of the green sand bed at Hornerstown, N. J., the lateral intersternal bones were distinctly seen in place. They present a rounded interior outline, and apply to an equal extent of the hyo- and hyposternal bones. They extend but one-third the distance to the median longitudinal suture, and are much as in the existing genus Podocnemis. The specimen observed measures 10.5 inches in width between the inguinal notches.

TAPHROSAURUS, Cope.

Suborder Streptosauria. Neural arch not coössified with the centrum, each neurapophysis attached in a rounded pit of the body.

This genus is proposed for the Plesiosaurus lockwoodii, Cope, Trans. Amer. Phil. Soc., 1869, 40. Were it a true Sauropterygian, I would continue to regard it as a Plesiosaurus, but it is, I have little doubt, one of the same type as Cimoliasaurus, which it resembles, except in the peculiar attachment of the neural arch. From the cretaceous clays of New Jersey, the No. 1 of Meek and Hayden.

Stated Meeting, January 7th, 1870.

Present, fifteen members.

MR. FRALEY, Vice-President, in the Chair.

Prof. Marsh, of Yale College, was introduced and took his seat.

A letter of envoy was received from the Central Physical

Observatory of Russia, requesting Vols. I–IX Trans. A. P. S., to complete its series, and Proc. Nos. 15, 62, 73, 74, 78, *et seq.*, which request the Secretaries were instructed to grant.

Letters of acknowledgment were received from the Bureau des Longitudes (xiii. 3,) (81); Venetian Institute of Sciences (77), and Leeds Philosophical Society.

Donations for the Library were received from the Institutions at Milan and Venice, S. S. Zantedeschi, Alianelli, and Ghirardini of Padua, Naples, and Milan, the Russian C. P. Observatory; the Academy at Berlin; Geographical Society at Paris; London Chemical, Leeds Philosophical, and Dublin Royal Societies; Dr. Haughton; Gard. G. Hubbard, of Cambridge, Mass.; the Boston N. H. Society; Franklin Institute; College of Physicians of Philadelphia, and the Librarian of Congress.

The Librarian reported the purchase of seven volumes of Comptes Rendus, (49, 50, 51, 52; 54, 55, 56,) for the Library.

A letter was received announcing the decease of Prof. A. J. Erdmann, Director of the Geological Survey of Sweden, at Stockholm, Dec. 1, aged 55.

A communication was read by the Secretary entitled, "Notices and Descriptions of Fossils from the Marshall Group of the Western States; with Notes on Fossils from other Formations; by Alexander Winchell, Director of the Geological Survey of Michigan." (See page 245.)

On motion of Prof. Cresson, the paper and section were referred to the Secretaries, with power to take order.

Prof. Cope communicated for the Proceedings a Paper on some Etheostomine Perch from Tennessee, and for the Transactions,

A Paper entitled, "On some Reptilia of the Cretaceous Formation of the United States," which, on motion of Dr. Horn, was referred to a committee, consisting of Mr. Lesley, Dr. Horn, and Dr. Rushenberger. Prof. Cope illustrated this paper by offering for the examination of the members present, unique specimens of a sauroid, found in the U. S. Armory grounds at Springfield, and described by Dr. Hitchcock, the true structure of which has but recently been made out, and explains the peculiar 8-shaped terminal impression so often

discovered among the foot-tracks of the Connecticut River red sandstone. (See pages 261–71.)

Mr. Chase made some remarks about Solar and Electric Light, in reference to recent experiments to determine the mechanical equivalent of terrestrial light.

The report of the Judges and Clerks of the Annual Election was then read, declaring the following persons duly elected:

President.

George B. Wood.

Vice Presidents.

John C. Cresson,
Isaac Lea,
Frederick Fraley.

Secretaries.

Charles B. Trego,
E. Otis Kendall,
John L. LeConte,
J. P. Lesley.

Curators.

Franklin Peale,
Elias Durand,
Joseph Carson.

Treasurer.

Charles B. Trego.

Counsellors.

Alfred L. Elwyn,
John Bell,
Benjamin H. Coates,
Benjamin V. Marsh.

Pending nominations Nos. 643 to 648 and new nominations 649, 650 were read.

Mr. Lesley was nominated for Librarian by Prof. Cresson, and the Society was adjourned.

Stated Meeting, January 21, 1870.

Present, seventeen members.

PROF. CRESSON, Vice-President, in the Chair.

Dr. Anderson, of Haverford, was introduced and took his seat.

A letter of acknowledgment was received from the Russian Observatory (78, 79, 80.)

A letter from M. Aglave, one of the editors of the Revue des Cours Scientifiques, No. 17, rue de'l'école de Médicine, requesting the Proceedings, was read, and the Secretaries directed to place the Review on the list of correspondents.

Donations for the Library were received from M. Zantedeschi, the Paris Geographical, and London Astronomical and Meteorological Societies, the Montreal Natural History Society, New York Lyceum, Philadelphia Journal of Medicine, and Numismatic Society, Mr. Stephen Colwell and Dr. Lea, the Smithsonian Institution, Dr. Hayden and Prof. Kirkwood.

The Committte to which was referred the Paper of Prof. Cope, for insertion at page 122 of the memoir now passing through the press, reported, recommending its publication and insertion at the place designated, and that so much of the plate accompanying it as illustrates *Megadactylus polyzelus*, be engraved and printed as an additional plate of the memoir. On motion, the recommendation of the Committee was adopted and the publication ordered.

Mr. Lesley referred to the accounts in the newspapers of the special violence of the late tornado at Cave City in Kentucky, and hoped that some accurate record would be made of the exceptional phenomena alluded to therein.

Mr. Fraley added that a proposition had been made at the

recent meeting of the National Board of Trade in Richmond, to obtain from Government an appropriation for a National Telegraphic Storm Survey, and suggested the propriety of the Society taking initiative steps to accomplish so desirable an object.

Prof. Cope exhibited a molar tooth found in the Miocene of New Jersey, with a characteristic development of tuberculous processes on the crown. He exhibited fragments of the skeleton of a new species of tertiary whale found in N. Carolina; and also some extraordinarily thin and flexible paper-like plates of Itacolumite.

On motion of Mr. Fraley, Mr. Lesley was re-elected Librarian.

The Standing Committees were then individually nominated and elected as follows:

Finance—Mr. Fraley, Mr. J. F. James, Mr. Marsh.

Publication—Mr. Trego, Mr. E. K. Price, Dr. Carson, Mr. R. A. Tilghman, Mr. Lippincott.

Hall—Mr. Peale, Mr. S. W. Roberts, Gen. Tyndale.

Library—Dr. Bell, Dr. Coates, Mr. E. K. Price, Rev. Dr. Barnes, Rev. Dr. Krauth.

The reading of the list of surviving members was postponed on account of the lateness of the hour.

Pending nominations 643—648 were read, spoken to and balloted for; and new nominations 649—655 were read.

On motion of Dr. Carson, it was

***Resolved,* That when Corrections, Improvements or Additions to Papers (made subsequently to their presentation to the Society and the order for their publication) involve a greater expense than has been estimated by the Publication Committee, such corrections, improvements and alterations be referred to the Society for approval.**

The ballot boxes were then examined by the presiding officer, and the following persons were declared duly elected members of the Society:

Prof. Oswald Seidensticker, of Philadelphia.

Mr. W. M. Tilghman, of Philadelphia.

Rev. E. E. Hale, of Roxbury (Boston), Mass.

John Greenleaf Whittier, of Amesbury, Mass.

Mrs. Emma Seiler, of Philadelphia.

And the Society was adjourned.

Stated Meeting, February 4th, 1870.

Present, ten members.

MR. FRALEY, Vice-President, in the Chair.

Letters accepting membership were received from Mr. W. M. Tilghman, dated Philadelphia, 1114 Girard street, Jan. 25, and Mrs. Emma Seiler, dated Philadelphia, Feb. 1, 1870.

Letters acknowledging the receipt of Proc. No. 82, were received from the Massachusetts, Rhode Island, New Jersey, and Georgia Historical Societies, and from the Peabody Institute in Baltimore.

The request of the Georgia Historical Society for a complete set of Proceedings A. P. S. was granted.

A letter was received from Prof. Charles E. Anthon, of the College of New York City, accompanying a donation for the Library of 44 numbers of the New York Numismatic Society Journal.

Donations for the Library were also received from the Russian Geographical, and Paris Ethnological Societies; Dublin Observatory; Boston N. H. Society; Amer. Antiquar. Society; Amer. Jour. S. and A.; Philadelphia Academy N. S.; Medical News and Library; Maj. Gen. Humphreys, and the Chicago College of Pharmacy.

The death of Horace Binney, Junr., at Philadelphia, on the 3d inst., aged 61 years, was announced by Mr. Fraley. On motion of Prof. Kendall, Chas. J. Stillé, Esq., Provost of the University, was appointed to prepare an Obituary notice of the deceased.

The extraordinary mildness of the Winter was illustrated by a fact communicated to the Secretary by Mr. Hector Orr, who watched carefully for two minutes the evolutions of a bat about the corners of Spruce and Third streets. Other members present gave similar illustrations; as for example, expanded blossoms gathered January 30th, in the open air: peach trees in blossom at Lock Haven, Pa., &c.

Mr. Chase communicated additional deductions from a study of the rain fall tables of the Philadelphia Hospital. (See p. 311)

Dr. Brinton introduced to the attention of the Society a valuable contribution to the study of the Choctaw language, in the form of a Grammar prepared by the venerable Missionary Byington, recently deceased. His long and zealous labors have resulted in the publication of a list of more than 75 works, including the Bible, in the Choctaw language. After four revisions of his Grammar, he was at his death engaged upon a fifth.

This manuscript, the fruit of 40 years' labor, has been forwarded to Dr. Brinton by Mr. Dana, Mr. Byington's son-in-law, and consists of portions of these five revisions, interlined, and somewhat confused in the order of its subjects, but thrown into two principal divisions, the first of which, on the Orthography of the language, is written out; while the other, on the Parts of Speech, will need to be carefully edited. Mrs. Byington and the other heirs, present it to the Society on condition that a committee be appointed to edit it, within a reasonable time. Mr. Folsom, a Choctaw gentleman, will soon be in Philadelphia, on a commission to publish the Laws of the Indian Government, and has promised his aid in proof-reading. The Grammar will probably make about 40 pages, 8vo., and require a few new types, obtainable at small expense. The Grammar will be of practical use in developing the civilization of the Tribes, as the language is extremely difficult. It has, moreover, peculiar claims to scientific attention; for the Choctaw, Creek and Chickasaw are affiliated dialects, spoken, at the time of the arrival of Europeans, by a people spread over a great part of the United States. There is no man now living capable of writing, or likely to attempt the construction of a Grammar of either of them.

A committee consisting of Dr. Brinton, Mr. Lesley, and Prof. Haldeman, of Columbia, Pa., were appointed to consider and report upon the subject.

On motion of the Secretary, the University of Indiana was placed on the list of corresponding societies to receive a complete set of the Proceedings, in answer to a request from Prof. Kirkwood.

On motion it was

***Resolved*, That the Secretaries be instructed to print with the next No. of the Proceedings, a list of the surviving members of the Society, and a request to all the members to send their proper addresses, and photographs for the Album.**

Pending nominations Nos. 649 to 655 were read.

And the Society was adjourned.

Stated Meeting, February 18th, 1870.

Present, six members.

PROF. CRESSON, Vice-President, in the Chair.

A letter accepting membership was received from John G. Whittier, dated Amesbury, 4th 2d mo., 1870.

A letter enclosing a photograph for the album was received from Daniel Wilson, dated Toronto, Univ. College, Canada, Feb. 8, 1870.

A letter acknowledging the receipt of Proceedings No. 82, was received from the Essex Institute, in Salem, Mass.

Donations for the Library were received from the Nicolai Hauptsternwarte at St. Petersburg; the Norwegian University at Christiania; the Society at Throntheim; the Austrian Academy and Geological Institute; the Görlitz Society; the Holland Academy and Natural History Society, and M. Höck; Sig. Lombardini; the new Geological Committee of Italy, at Florence; the Society of Physical and Natural Sciences at Bordeaux; Paris Geographical Society; London Astronomical Society and Society of Arts; Essex Institute; Dr. B. A. Gould; Dr. S. A. Green, of Boston; Mr. E. A. Stone, of Providence; the Franklin Institute and School of Design for Women, in Philadelphia; Col. W. W. H. Davis; the Ameri-

can Pharmaceutical Association; the Hon. Secretary of War of the United States; the U. S. Observatory, and the Chicago Academy of Sciences.

For the Cabinet was received a medal of bronze from the Batavian Society of Experimental Science, at Rotterdam, with the design:

Truth, erect, leaning on a Thyrsus, wrapped around the staff of which is the legend RERUM MAGISTRA: in her right hand, an anchor, pendant; before her, a tripod and flame; behind her, an altar supporting a pair of scales, and on its face the coat-of-arms of the Society; over her the legend, CERTOS FERET EXPERIENTIA FRUCTUS; on the reverse, a serpent with its tail in its mouth; outside of it, the circular legend IN MEMORIAM STEPHANI HOOGENDIJK FUNDATORIS MDCCLXIX—MDCCCLXIX; inside of it, the legend, SOCIETAS PHILOSOPHIÆ EXPERIMENTALIS BATAVA ROTERODAMI CENTESIMUM NATALEM CELEBRANS.

Mr. Price remarked upon the uncommonly mild weather, and reported a crowd of persons in Chestnut above 10th street, about 2½ P. M., collected to watch the flight of a bat, after which it remained clinging to a wall. During the hour previous to the meeting, a thunder storm passed over the city, and two houses were struck by the lightning.

Prof. Cope communicated descriptions of new cretaceous fossils from North Carolina, &c. (See p. 284.)

The minutes of the last meeting of the Board and Council were read.

Pending nominations Nos. 649—653 were read.

And the Society was adjourned.

Stated Meeting, March 4, 1870.

Present, eleven members.

DR. WOOD, President, in the Chair.

Prof. Seidensticker was introduced and took his seat.

A letter accepting membership was received from Charles Darwin, dated Beckenham, Down, Kent, S. E., Feb. 5th, 1870.

Letters of acknowledgment and of envoi were received from the Georgia Historical Society, Savannah, Feb. 15th, and T. A. Wylie, Librarian of the Indiana State University, Bloomington, Feb. 16, 1870.

A letter requesting exchanges was received from Dr. Jelinez, Director of the Imperial Central Meteorological Institute, Secretary of the Austrian Meteorological Society, [K. K. Centralanstalt für Meteorologie und Erdmagnetismus,] which was on motion referred to the Secretaries, with power to place that Institute on the list of correspondents to receive the Proceedings.

Donations for the Library were received from the Austrian Novara Expedition; the R. Prussian Academy; the Montreal, and Boston Natural History Societies; the American Oriental Society; Prof. J. D. Dana; the Philada. Academy Natural Sciences; the Maryland and Georgia Historical Societies, and the Adjutant General of Maryland.

The Committee to which was referred the acceptance of the Choctaw Grammar, prepared by the late Cyrus Byington, reported in favor of its publication by the Society, on the terms proposed by the heirs of the deceased missionary.

The President, Dr. Wood, made a communication on the subject of the Indian skeleton found upon his cranberry lands in Southern New Jersey.

He particularly called attention to the characters of the cranium, the separate bones of which had been skillfully put together by Prof. Leidy. The most striking peculiarity was the extraordinary breadth of the cranium, which exceeded that of most European heads; and altogether the size of the cranium was much greater than that of the head of the present race of Indians. The cranium was compressed behind; and the frontal bones had apparently been artificially somewhat flattened. Altogether, the head was very different from that of the ordinary Indians, and probably belonged to a race which had preceded that found here originally by Europeans. From the apppearance of the skeleton, it was probably more than 500 years old, perhaps 1,000. It was more changed than that of the Mastodon recently discovered in the same neighborhood, which, as Dr. Wood had been informed, was about four feet below the surface.

A communication intended for the Proceedings, was received from Prof. Kirkwood, of Indiana University, Bloomington, Ind., entitled "On Certain Meteoric Rings." (p. 299.)

A communication was made by Prof. Cope, "On Adocus, a genus of Cretaceous Emydidæ." (See p. 295.)

A verbal communication was made by Mr. Chase, on the subject of the Tides. After referring to the diametrically opposite conclusions expressed by Astronomer Royal Airy, and Prof. Challis, respecting the theoretical position of the tidal ellipsoid, and the claim of each, that his views coincide with those of Newton and La Place, Mr. Chase suggested, that a practical solution of the difficulty may perhaps be found by adopting the intermediate position, analogous to that of the barometic spheroid.

A communication intended for the Proceedings was presented by Dr. Brinton, entitled, "Contributions to a Grammar of the Muskokee Language." (See p. 301.)

Pending nominations Nos. 649 to 655 were read and new nomination No. 656. And the Society was adjourned.

VERBAL COMMUNICATION BY E. D. COPE, AT MEETING OF THE A. PHIL. SOC., FEB. 18, 1870.

Prof. Cope made some observations on the extent of the order Pythonomorpha as exhibited in cretaceous rocks of the United States. He stated that he was acquainted with twenty-seven species of the group, and that but three were enumerated in the last work on the subject. He defined two new species of Mosasaurus from New Jersey. One of medium size, was from the lower bed in Monmouth Co.; it had round articular vertebral faces, and a peculiar cariniform angle from the pit on the outside of the os quadratum. It was named *Mosasaurus fulciatus*. Another and larger species was described under the name of *Mosasaurus oarthrus*, as of about the proportions of the M. giganteus of Mæstricht, but with depressed vertical centra like those of the M. depressus. The quadrate bone differed from that of M. depressus and resembled that of M. dekayi. From Cook's middle marl bed (Cretaceous) of New Jersey.

He also alluded to the occurrence of the Rhinoceros, Dugons, etc., in certain beds in New Jersey, as indicative of the existence of Indian types at one time in this region. He added the genus Sus, at present unknown in the New World, but characteristic of the Palæotropical region. He said his knowledge of its existence depended on an imperfect posterior inferior molar, found near Squankum by Dr. Samuel Lockwood. He named the species *Sus vagrans*, and said it was near the size of the domestic hog.

FOURTH CONTRIBUTION TO THE HISTORY OF THE FAUNA OF THE MIOCENE AND EOCENE PERIODS OF THE UNITED STATES.

By E. D. Cope.

ESCHRICHTIUS, Gray.

Eschrichtius polyporus, Cope.

Species nova.

Character. Ramus mandibuli with coronoid process but little elevated; form compressed with narrowed acute superior margin, which is not flattened posteriorly. On its inner face a wide shallow groove, in which the inner series of foramina lie. Foramina of outer series large, numerous. Size large.

Description. This whale, from the form of the ramus mandibuli, is a finner, and from the slightly developed coronoid process, allied to the humpbacks. The coronoid, the anterior position of the dental foramen, and the angular process, confirm these relationships. Whether it be a Megaptera or Eschrichtius I am not prepared to state. Ear bullae of the forms of both these genera occur in the strata in which the present species was found, and future investigation must determine which are referable to the latter. Such a bulla of the form of and probably belonging to, Megaptera, has been named *Balaena mysticetoides*, by Emmons. (North Carolina Geol. Survey Tab.)

The fragment which on the present species is based, is the proximal two-fifths the left ramus mandibuli, with a considerable part of the condyle. The direction of the shaft from a short distance anterior to the coronoid process, is decurved. The inferior margin is slightly contracted below the coronoid process and then for a short distance convex, and narrowed into a ridge; anteriorly it is most obtuse or convex transversely. The inner face is plane at the coronoid process, the outer convex. Anterior to this point the convexity is strong; at the distal end of the fragment, much less marked.

The angular process has extended beyond the line of the condyle; its extremity is broken away. A wide groove separates it from the base of the condyle on the inner face of the ramus. The surface of the condyle is transverse to the plane of the ramus, and is strikingly elevated above the portion of the ramus anterior to it, being as high as the tip of the coronoid process. A low knob projects on the inner face of the ramus beneath its anterior part, and below the groove. The dental foramen is large, and is overhung by the thin incurved superior margin of the ramus. Its anterior margin terminates just behind the posterior part of the base of the coronoid process.

The pores of the inner series are small and numerous; the last one is a little anterior to the base of the coronoid process (34 lines). They are situated in a wide shallow groove, which occupies a portion of the inner face of the ramus below the upper edge. Their interspaces are not quite equal; thus twenty lines separate two, and four are included in thirty-

six lines. The foramina of the external series are more numerous than in any of the other species from the Miocene of our Eastern States. As in others the last pairs are less spaced than the anterior. In a space of six inches and twenty lines, there are six foramina, the third from behind nine lines below the superior margin. Thirty-four lines separate the anterior pair; twenty-two the posterior. The last foramen is about a half an inch anterior to the plane of the last one of the inner side.

	Feet.	Lines.
Length of fragment	2	42
Depth just behind coronoid		56
" " in front of coronoid		66
" at fourth inner foramen		62
Diameter " " "		27

This ramus chiefly resembles that of Eschr. cephalus from Maryland. It is less compressed, though crushed, and less attenuated on the upper margin near coronoid process; the coronoid process considerably smaller. Outer series of pores more numerous and extending further back. Inner in a marked groove, which is wanting in E. cephalus. Outer wall of angular region more everted. Inferior wall of dental or mandibular canal descending from margin of foramen in E. cephalus and ascending in E. polyporus.

From the Miocene Marl of Edgecombe Co., North Carolina. Obtained by the writer under the auspices of the North Carolina State Geological Survey, under Prof. Wm. C. Kerr, Director.

Vertebræ, which as to size and structure would accord with the present species, are not uncommon in the same deposit; their description is reserved for a future occasion.

MESOTERAS, Cope.

Genus novum.

Character. Orbital process of frontal narrowed, exceedingly thick and massive at the extremity. Posterior lumbars and anterior caudals with short antero-posterior diameter. Premaxillary and maxillary bones depressed, the latter thin, horizontal, narrow. Otic bulla compressed.

This genius is allied to Balaena in the form of its vertebræ, and to some extent in that of its frontal bone. The flatness of the maxillary and premaxillary is rather that of Balaenoptera. The extraordinary mass of the superciliary portion of the frontal is peculiar to the species which forms the type of the genus so far as known.

MESOTERAS KERRIANUS, Cope.

Species nova.

This species was discovered by Prof. Wm. C. Kerr, Director of the Geological Survey of North Carolina, in a bed of miocene marl, at a point where it is cut by Quanky Creek, a tributary of the Roanoke river, in Halifax county, North Carolina. A portion of the cranium had been noticed for some years projecting from the steep bank or wall of the small cañon of the creek, at about thirty feet below the surface of the ground.

Prof. Kerr, with the aid of a number of men, dug from its bed and elevated to the surface of the ground a large fragment of the cranium, including the greater part of the left maxillary and premaxillary bones, with a large part of the frontal. A large fragment of the right ramus of the mandible, an otic bulla, several lumbar and caudal vertebræ, with several broken ribs, were also obtained.

These remains indicate not only a species, but a genus new to science, and the largest extinct Balænoid yet discovered.

The principal mass includes from the posterior margin of the transverse process of the frontal, to within four or five feet of the end of the muzzle. The mass measures eleven feet six inches in length. The fragment of the ramus mandibuli measures thirteen feet; five feet are probably lost distally, and there is no trace of coronoid process at the point where it is broken off proximally. The length of the restored cranium would not be less than eighteen feet. This gives for the total length, estimating on the basis of Megaptera, seventy-five to eighty feet.

The orbital process is nearly in line with the maxillary, probably in consequence of pressure when lying in an oblique position. The whole cranium has been injured from the same cause, and the matrix usually soft, formed a solid investment of carbonate of lime from the carbonic acid liberated during decomposition, which required several days' labor to remove. The parietal, occipital, and other bones of the brain-case proper, were not recovered.

Description. The upper surface of the muzzle is but little decurved anteriorily. A portion of its outer margin, at the posterior part, is preserved, so that its width is known. The maxillary forms a rather thin lamina, and does not present any great median decurvature, as though the vomer was not prominent below. Perhaps this peculiar flatness is partly due to pressure, but the *premaxillary* presents a similar character, which is evidently normal. This element forms one margin of the mass, and the question as to whether the exposed face were the outer of the right, or the inner of the left bone, required some care for its solution. Anteriorly it is three inches in depth, near the posterior extremity, two inches. The greatest width near the middle, six inches. The margin next the remainder of the mass, is rather the more elevated; the external somewhat prominent and rounded. Beneath it a deep groove marks apparently the exit of a foramen. A groove in the same line is seen at various points throughout its length where exposed. This bone is thus much flatter than in any of the Finner whales, and resembles more that of the right whales. The outer face being nearly plane, it can scarcely be the vomerine face, which is concave, especially so in Balæna, for the accommodation of the cartilaginous axis. The foramina and grooves are equally present in both these genera, on the external side; I therefore conclude that the external side of the right premaxillary is the one exposed, and that the width of the muzzle includes the left premaxillary, and maxillary. The suture between the latter is not distinct, owing to the presence of longitudinal fractures. The width of the maxillary after the premaxillary

is deducted, is not great, and is intermediate between that seen in Balaena and Megaptera. The right premaxillary may be traced for six feet two inches. Behind it a portion of the superficies of the cranium slopes towards the position formerly occupied as a blow hole.

The margin of the *maxillary* is horizontal, and rather thin. It becomes thicker posteriorly where it has been crushed back on the lateral orbital process of the frontal. Its acuminate extremity is seen lying on the latter.

The orbital process of the *frontal* is remarkably massive, and might at first be taken for the squamosal. Its posterior margin is free to within a foot of the probable position of the blow holes. This fact, in connection with its deep postero-inferior concavity in cross section, is conclusive as to its relations. The form is not horizontally expanded as in Megaptera, nor attenuated as in Balæna, but has rather the proportions seen in Reinhardt's figure of the young of Balæna mysticetus. (Om Nordhvalen Pl. III.) That is, it has subparallel anterior and posterior sides; the extremity a little widened by the production backwards of the posterior portion. The anterior portion also somewhat, though less, protuberant. The whole extremity truncate and remarkably thickened. Thus it is nineteen inches long, the anterior tuberosity seventeen inches deep, the posterior twelve inches deep; the inferior outline nearly straight. The orbital concavity, which is continuous with the optic foramen, opens behind the posterior tuberosity, and is defined exteriorly by the expanded posterior margin of the bone. Thus the great tuberosity which gives character to the bone was above and in front of the eye.

The portion of the *mandible* preserved presents marked characters. The inner face is slightly concave, or plane, the external strongly convex. The inferior edge is narrowed, and the superior scarcely less so; the inner face rounds a little to the former, and to a wide groove just below the latter. This groove is one inch wide near the middle of the ramus, and is marked by a series of many small foramina. These are closer together in the anterior, and regularly more widely spaced to the posterior portion. Thus anteriorly they are 2.5 inches apart; posteriorly four inches separates them, and near the extremity of the series, six inches. I failed to find any foramina on the external face of the ramus. It is difficult, however, to believe that they are totally absent; it may be that they are confined to the anterior portion, which has not been preserved. This peculiarity, if entirely established, marks the species as quite distinct from any heretofore known from characters of the mandible. The depth in this species, at the point where the foramina are four inches apart, is fourteen inches.

There are some other pieces apparently belonging to the cranium, whose exact positions I cannot now assign. One of these looks like a segment of ramus of the lower jaw, but the convergence of the superior and inferior outlines is too great. One face is plane-concave, the other convex flattened, with oblique superior and inferior faces, the latter the widest. Depth of plane, ten inches; do. exterior flattened face, 7.75 inches. Depth

six inches from same point, 7.5 inches. The second uncertain fragment is long and with parallel margins. The outer face is strongly convex; the inner, at one extremity concave, so that a section would be half a crescent (the lower portion being lost). The inner face gradually becomes convex, though not strongly so, and the long diameter is transverse, while it is vertical at the anterior end. The former is seven inches; the latter eight inches. The fragment looks like the extremity of a premaxillary bone, possibly a maxillary, but it is scarcely appropriate to the premaxillary already described.

The periotic bones of the left side were preserved almost entire. The bulla has the flat inferior face of the genus Balæna, and the periotic processes are exceedingly short, shorter even than those of the species of Balæna (B. mysticetus and B. cisarctica). The external process is not longer than the posterior, and is compressed and deeply grooved longitudinally below. The posterior process is at right angles to the exterior, and as broad as long. It bears a sublongitudinal ridge near the middle of its inferior face; anterior to it, separated by an interval a transverse ridge occurs to which the edge of the thin lip of the bulla is attached. The anterior process contains the usual foramina, and is broader than long. The superior face of these bones is quite rugose. The bulla is more flattened, *i. e.*, has a shorter vertical diameter, than either that of Balæna mysticetus or B. cisarctica. The circumference is not a sharp edge as in B. cisarctica, but is truncate and rugose, at the inner extremity most so. At the external extremity the face gives way to a rounded edge. The inferior face is coarsely impressed punctate, and has a curved depression inside the anterior margin. The posterior margin is marked by the usual three grooves with intervening enlargements. The general outline, viewed from below is hexagonal, with the lengths of the sides as follows, beginning with the longest; posterior, anterior, interior, postero and antero-exterior equal, antero-interior very short. The bulla of B. cisarctica exhibit a long posterior and long interior side, connected by an arched outline.

The vertebræ are those of the genus Balæna. The general form of the centra of anterior lumbars and caudals, is abbreviated, especially the latter. The diapophyses of the former are thick at the base; one of those preserved may be a posterior dorsal, but the ends of the diapophyses are not preserved. In a caudal with very short diapophyses, which are a little nearer the basis of the chevrons than that of the neural arch, a small foramen penetrates the centrum from a point three inches above the base of the diapophysis, and issues at a point 2.5 inches below it. The articular faces are convex; there is a small rugose central area, and an external annular space with coarse concentric ridges.

Measurements.

	Ft.	In.	Lin.
Length of fragment of O. maxillare to extremity which reposes on frontal	9	8	
Width of same (with left premaxillary) at 42 inches from extremity.....		16	

	In.	Lines.
Transverse diameter periotic bulla	5	8.7
Longitudinal	4	9.5
Vertical	3	1.5
Length external periotic process	1	9.5
" posterior " "	2	2
Length centrum anterior lumbar No. 1	10.75	
Vertical and transverse diameter do. each	12	
Width neural canal	5	
Length diapophysis	17	
Width do. at base	7	
" " " middle	6	
Length centrum lumbar No. 2	10.5	
Both diameters of articular face	13.	
Width neural canal	5.5	
" antero-posterior neural spine	5.	
Length centrum of a caudal	6.5	
Diameter articular face, (vertical)	14.	
" " (transverse)	14	6
" neural canal	1.5	
" inter-chevron groove	3	

As compared with the described species, the characters of the Mesoteras kerrianus are well marked. Thus the ear bone is totally different from that of Eschrichtius cephalus and E. mysticetoides (*Balæna* Emmons, Leidy), and the mandibular ramus is not flattened above, as in E. priscus and E. expansus. The paucity or absence of external foramina distinguish it from the E. polyporus. Finally, E. leptocentrus presents generic characters in its known cervical vertebræ which will not probably be found in the present whale. Though these vertebræ of Mesoteras have not yet been found, I anticipate that they will present more nearly the characters of the genus Balæna, in accordance with the remainder of the structure. Perhaps they will be like those of Palæcetus of Seeley, and the two genera may be found to be the same.

It has been known to geologists and others for some time, that a skeleton of some kind had been exposed by the erosive action of the waters of a creek in Eastern North Carolina, and was to be seen lying in its bed diagonally across it. The writer recently visited the spot, and found the stream to be some fifty feet in width, containing water of from three to five feet in depth. The direction and extent of the skeleton was indicated by the proprietor, Jesse W. Parker, since the water concealed it from view. It would appear to extend very nearly across the creek, and have a length of 60 to 70 feet. Some of the vertebræ could be distinguished by feeling with a rod. When the waters are low towards the end of the summer, its length is exposed, and it can be used as a foot log by the traveller. On the bank near this skeleton were found portions of the skeleton of an adult firmer whale of some thirty feet in length.

Prof. Kerr, Director of the survey, succeeded in obtaining one or two of

the lumbosacral vertebræ of the specimen which is above noticed. These were submitted to me at Raleigh. They belong to a right whale, or one nearer to Balæna than Balaenoptera. They are in fact identical in character with those of the species Mesoteras kerrianus, and belong probably to it. The following is a description of one of them from the posterior dorsal or anterior lumbar region.

Median line below, obtusely keeled, sides a little concave. Articular face with a large median elevated area, which is coarsely obsoletely rugose; the marginal area exhibits fine concentric rugosities.

Measurements.

		Inches
Length	centrum	7
"	basis of diapophysis	4.5
Depth	" "	3.25
"	articular face	8.5
Width	" "	9.
Thickness	of epiphysis	.75

The epiphyses are free and the individual is young.

A vertebra of similar character to, and rather larger size than any here described, was obtained by the writer near Nahumta, Wayne Co., N. Ca. The species would not appear to be rare.

This whale is named for Prof. Wm. C. Kerr, of Raleigh, who has vitalized the State survey, and is prosecuting it with advantage to all branches of science that lie within its scope.

SUS, Limaens.

Sus ?sp.

Represented by the crown of an inferior posterior molar of an animal not fully grown. Both extremities are broken off, but sufficient remains to indicate the genus of the animal beyond doubt.

The two principal lateral and adjacent median tubercles of the tooth present the characters of the same parts in the *Sus scropha*, and indicate a species of about the same size. A section of each lateral lobe is therefore slightly trifoliate, and the two inner ridges, whose sections constitute the lobes, are transversely deeply wrinkled. The margins of the broader outer lobes are also wrinkled, the wrinkles sometimes continued into shallow grooves on the outer face of the same. The convex outer face is marked by delicate concentric linear grooves, the apex of the lobe being the centre of the arcs. The anterior and posterior median tubercles are much the same as in *S. scropha;* in the former the crown is nearly three times as wide as long, as in *S. scropha.* The posterior median tubercle is sub-trilobed, and a little broader than long; surfaces of both tubercles rugose plicate. A pair of shallow longitudinal grooves on the outer face of each lateral tubercle.

The inferior face of the crown presents a not uncommon peculiarty in the isolation and deep conic form of the prolongations of the pulp cavity, which correspond to the tubercles. In another specimen which I refer to the *S. scropha*, these prolongations are connected by grooves which enclose diamond-shaped interspaces.

	M. M.
Width crown at base,	0.0163
" between apices lateral tubercles,	.007
Length, including median tubercles,	.014
" anterior median tubercle,	.003
Width " " "	.008

This is one of the interesting discoveries made by Dr. Lockwood, of Keyport, N. J., in the fossiliferous strata of his region. He obtained it of a farmer, with a number of other fossils of the upper marl bed in Monmouth Co., N. J. The farmer used the marl of that stratum as manure, and probably found the present specimen while digging it. The color of the tooth is black like that of other Miocene and Eocene fossils of that region, and though on application to a flame it shows the existence of a small amount of carbonaceous organic matter, it does not give out the odor perceived in the post-tertiary bones of New Jersey, when burned.

Recently, my friend, Oliver N. Bryan, sent me from Stafford Co., Virginia, a similar posterior molar from the inferior series of a hog. On contact with a flame it evolves such an odor of organic matter, and combustion leaves such distinct traces of carbon, that I am unwilling to consider it a fossil. It is stained of a strong red color, which does not penetrate far below the surface as does the black in the specimen above described. Its posterior median tubercle is accompanied by a smaller tubercle on the inner side; behind it an opposed pair of rudimental proportions follows, and as the crown narrows to a sub-acute termination, a still lower median tubercle finishes the series. The anterior extremity of the tooth is broken away. In these unused crowns, the edges of the tubercles are crenate, and the inner and median lobes and tubercles are coarsely plicate.

THINOTHERIUM, Cope.

Family *Hippopotamidæ*. Dentine thrown into transverse ridges on the basal half of the second inferior incisor, otherwise probably as in Hexaprotodon, or with three superior incisors at least.

This genus is indicated by a second inferior incisor of the right side. It resembles that of the genus Hippopotamus, but differs in the annulate character of the surface of the dentine of the proximal portion of the fang. The worn exterior face near the extremity, indicates the friction of the usual large second superior incisor, while a corresponding worn surface on the opposite side of the extremity, indicates the presence of the inner or third superior incisor characteristic of Hexaprotodon and not found in Hippopotamus. The base of the fang exhibit the usual short pulp cavity, and is compressed, not rounded, as in Hippopotamus and Chœropsis, as though there were an additional, or third inferior incisor also. Apex of tooth narrowed obtuse.

Structure of dentine concentric.

THINOTHERIUM ANNULATUM, Cope.

Species nova.

Second inferior incisor slightly curved both outwards and upwards. Section of basal half, a vertical oval; beyond the middle, at worn surfaces,

quadrangular, with one angle upwards and the extero-inferior side convex. This is occasioned by the presence of a third flattened side, besides the two worn faces, at right angles with the interior worn face. It presents a short longitudinal groove, which may be abnormal. Extremity narrowed, sub-round, obtuse. The direction of the outer worn surface is outwards and backwards.

	M. M.
Total length,	0.0543
Vertical diameter at base,	.0117
Transverse " "	.0075
" " near tip,	.006

The color of the tooth is dark red, and it has not penetrated far into the dentine. On application to a flame, a very faint odor of organic matter may be perceived, and a slight trace of carbon may be detected. The surface is considerably worn, so that it cannot be determined whether there was a coat of enamel originally or not. It was discovered in Stafford Co., Virginia, at the same locality from which the molar of the hog above described, was procured. They have both been rolled, and are both of a red color.

The Thinotherium annulatum was a small Hippopotamus-like animal, about the size of the wild boar. As it was no doubt like its recent allies, a shore-and-swamp-loving beast, I name it from $\theta\iota\nu$ the shore, or $\theta\eta\varsigma\acute{\iota}o\nu$, a wild animal.

The discovery of the Hippopotamus in America, by O. N. Bryan, and the hog, by Dr. Lockwood, is of considerable interest. Neither types have been heretofore known in either extinct or recent condition (except as introduced), and are, therefore, not included in Leidy's recent Synopsis of Fossil Mammalia of North America, in the Journal Acad. Natl. Sciences, Phila. De Castro, in an essay entitled, "De la Existencia de la grandes Mammiferos Fossiles en la Isla de Cuba," Havana, 1865, states that remains of Hippopotamus occur in the Island of Cuba, referring them to an extinct species. Leidy remarks on this,* that they are probably recent, and cites examples of specimens used for making artificial teeth by dentists, having been brought to him as fossils.

MYLIOBATIS, Cuvier.

MYLIOBATIS GLOTTOIDES, Cope.

Spec. nov.

Established on three specimens, one of which presents a series of eight teeth very convex in longitudinal as well as transverse direction. On the median line the teeth are suddenly swollen, forming together a broad obtuse median ridge. The lateral portions on either side are each slightly convex, and thin off to a margin which embraces but a single series of lateral teeth. Each transverse tooth is nearly straight, the extremity slightly and abruptly curved backwards. Each tooth is both wider (longer) and deeper than in most of the described species. The worn surface forms a subtriangular concavity.

* Proceed. Acad. Nat. Sci., Phil., 1868, 179.

	Lines.
Length of eight teeth over convexity	41
" of stoutest tooth	6.3
Depth of vasodentine of do	7
Width of same tooth (over convexity)	28

Laminar face obtusely angulate on the median line below.

This species is thick-toothed as in M. pachyodon and M. holmesii, but they are not so clearly three-ribbed in section as this one. The M. rugosus is somewhat similar, but is much wider, with more curvature of teeth and double row of laterals.

From the marl pits of the Freehold and Squankum Company, in the Eocene bed at Farmingdale, Monmouth Co. N. J.

MYLIOBATIS RECTIDENS, Cope.

Represented by seven consecutive teeth extending from the concave triturating surface, to the end of the series. There are two lateral series of teeth on each side, of which several of those of the inner series at least are wider than long. Those of the median series are entirely plane, and with perfectly straight transverse sutures. The series is very slightly convex in both directions.

	Lines
Length of seven teeth	38
Width of each median tooth	15
Depth of vasodentinal layer	4

This species is to be compared with the M. vicomicanus m. In it there are twice as many (12) teeth in a series of the same length and width as the present; the median series are recurved at the extremities; in this one straight.

This species is from Harrisonville, N. J., from marl excavations which are chiefly in the upper bed of Cretaceous green sand. The rusty color of the specimen indicates that it came from the upper part of the excavation, and therefore probably from a miocene stratum which Prof. Cook shows frequently overlies the green sand proper.

COELORHYNCHUS, Ag.

COELORHYNCHUS ACUS, Cope.

Established on a portion of the muzzle of a fish similar in some respects to the C. rectus, Ag., but smaller than it and much less than the C. ornatus, Leidy, from the same locality. The fragment presents a single median cavity, and externally nineteen ridges separated by narrow grooves; in the C. ornatus there are from thirty to forty in the same portion of the length. Diameter 1.3 lines. From the Eocene Marl of Farmingdale, Monmouth Co. N. J. I am indebted to A. J. Smith, Superintendent of the pits, for this and other valuable specimens.

ON ADOCUS, A GENUS OF CRETACEOUS EMYDIDÆ.

By E. D. Cope.

ADOCUS, Cope.

Proceed. Acad. Natl. Sciences, Phila., 1868, 235.

Character. Anterior and posterior lobes of the plastron abbreviated, narrowed, and not emarginate. Eight paired sternal bones; twelve sternal scuta, the humerals extending anteriorly, the pectorals and gulars both small. A series of plates—"intermaginals" within the marginals, on the sternal bridge. Rib heads, i. e. the capitula, wanting in the species whose costals have been examined.

This genus was originally described with *Emys beatus* Leidy from the Cretaceous Green Sand of New Jersey as the type, and its primary character was regarded as the absence of the costal capitula. In the synopsis of extinct reptilia of New Jersey, published in Prof. Cook's Geological Survey of that State, five species were numerated, as follows; *A. petrosus*, Cope, *A. firmus*, Leidy, *A. beatus*, Leidy, *A. pravus*, Leidy and *A. agilis*, Cope. The two species first enumerated having subsequently been found to possess well developed costal capitula, I referred them to Emys, in the "Synopsis of extinct Batrachia and Reptilia of North America," p. 126. My specimens of *A. agilis* being at the time very imperfect, it was not described.

In the present essay I propose to point out its characters, as well as those of the other species of the genus. Two species are added, the whole number being then five. One of these is from the Cretaceous deposits of Wyoming, the others from New Jersey.

The plastron in this genus presents marked peculiarity. The great reduction of the anterior and posterior lobes gives it a form pointing to that of Staurotypus. The anal scuta are of large size, and the humero-abdominal scutal suture (in A. agilis) extends across just in advance of the inguinal notch. The abdominal is the widest pair of scuta, in consequence of the relatively great longitudinal extent of the bridge; their anterior outline falls a little behind the axillary notch. The humeral scuta have a remarkable anterior extent, so much so as to lead to the suspicion that they were confluent with the pectorals, or perhaps wanting. In the case of *A. pectoralis*, having only the hyosternal bones, I was induced to think that they were really the pectorals, and that the abdominals were the true humerals, as is seen in the genus Pleurosternum; the posterior position of the humerals in the latter being owing to the existence of an additional pair of sternal bones. An examination of that structure in *A. agilis* and *A. wyomingensis*, dispels this view, and shows that the true pectorals are much shortened, and have an anterior position, and that the gulars are also small and narrowed, the genus approaching Chelydra in these respects.

The lateral series of abdominal marginals is seen in the existing genera Macrochelys and Dermatemys. The affinity of Adocus is to the latter, but the entire acuminate free lobes of the plastron, distinguish it well. The lateral marginal scuta in *A. agilis*, *A. wyomingensis* and *A. pectoralis*

are very distinct in our specimens, while I have seen it in only one of the two or three in which the bridge is preserved in A. beatus. In A. pravus I have not seen it, but the contracted entire xiphisternal elements pointed out by Leidy are quite like those of A. beatus, to which it is indeed very nearly allied.

The narrowed form of the posterior lobe is best seen in the specimen of A. wyomingensis described by Leidy, and in a specimen of A. beatus noticed by me in Synopsis Batr. Rept. N. A. p. 129. I there state that it is emarginate, an error consequent on a certain assymetry of the specimen, and its fractured condition. In A. agilis it is apparently rather better developed.

The form of the anterior lobe is easily seen to be narrowly reference to my figure of *A. pectoralis* (Syn. Bat. Rept. N. A.) Tab. VII fig. 1), or Leidy's figure of *A. pravus* Cretac. Rept. N. Am. XIX fig. 1. In the nearly perfect specimen of *A. vyomingensis* this portion is broken away, but Leidy describes this portion of a specimen, which has the character of the above species.

The species differ much in the relative stoutness of their shells, especially of the plastron. A pectoralis is the stoutest as well as the smallest; A. pravus and A. agilis are the thinnest, the latter the largest of the genus. No portions can be certainly ascribed to the crania of this genus.

In specimens of A. agilis, A. pravus, and A. beatus, the longitudinal median suture of the plastron presents much irregularity from the union of the alternating bones across the point of meeting of four, by an oblique portion of the suture.

Thickness of hyosternals less than four times in the transverse extent of same; intermarginals shorter; mesosternal prolonged posteriorly; smooth below; small. A. PECTORALIS.

Thickness of hyosternals one-eighth transverse extent of same; above with slightly impressed dots or delicate grooves, closely placed; larger, vertebral bones wider, A. BEATUS.

Sternum thick; vertebral bones narrower; carapace more coarsely longitudinally impressed grooved; mesosternal deeply received; lateral intermarginals elongate. A. VYOMINGENSIS.

Plastron quite thin; mesosternal deeply received into hyosternals. A. PRAVUS.

Plastron quite thin; mesosternal occupying an open concavity of the hyosternals; surface everywhere delicately impressed punctate and grooved; intermarginal scuta very long and narrow. A. AGILIS.

ADOCUS PECTORALIS, Cope.

Pleurosternum pectorale, Cope. Proc. Ac. Nat. Sci. Phila., 1868, 236; Trans. Amer. Philos. Soc. XIV, 1869, 130; Tab. VII, fig. 1.

Indicated by a pair of perfect hyosternal bones from the upper Cretaceous marl bed near Medford, Burlington Co, N. J.

ADOCUS BEATUS, Leidy.

Emys beatus, Cretaceous Reptiles, N. Amer. p. 107 Tab. XVIII, fig. 1-3. *Adocus beatus*, Cope, Proc. A. N. S., Phila., 1868, 235. Geological survey, N. Jersey, App. C. p. 734.

Not uncommon. It is considerably less stout than the preceding. The edges of the posterior lobe of the plastron are thinned out by an submarginal groove. As in other Emydoids there is a marked concavity for each pubic bone. The suture between the hyo- and hyposternal bones is less interlocking than in *A. agilis*, and less fine than in *A. pectoralis*. I have suggested that it may have possessed a slight mobility in life. Its face is longitudinally grooved in the hyposternal, and a corresponding convexity of the face of the hyosternal fits it. In a specimen from Medford, N. J., the posterior lobe is 5 inches 9 lin. long, and 5 inches, 8 lin. wide at the inguinal notches. Hyosternal of nearly equal thickness; medially 7 lines.

ADOCUS VYOMENGENSIS, Leidy.

Emys vyomingensis, Leidy, Proc. Ac. Nat. Sci., Phila., 1869, p. 66. *Baptemys wyomingensis*, Leidy, loc. cit., 1870, January.

Best known from an almost complete specimen consolidated by the contained mass of mineral. There are three intermarginal bones, of which the middle one is more elongate than the others. There is a weak carina on some of the posterior vertebral bones. The posterior marginal bones are not revolute. The costal bones are delicately grooved in the length of the carapace. The anterior extremity of the anterior sternal lobe is narrowed, prominent, and truncate. Length of the whole animal about two feet.

Found near Ft. Bridger, Wyoming Territory, by Dr. Van Carter.

The genus Baptemys to which this species is referred by Leidy, appears to be the same as Adocus.

ADOCUS PRAVUS, Leidy.

Emys pravus, Leidy. Proc. Aca. Nat'l. Sci., Phila., 1856, 303. Cretaceous Rept. U. S. 108. *Adocus pravus*, Cope. Synopsis Batr. Rept. N. Am. 129.

This species is as yet known only from the original specimens, in the collection of the Geological Survey of New Jersey. The plastron is thinner than in three preceding, and the hyosternals embrace the mesosternum extensively. This distinguishes the species from *A. agilis* where the mesosternal emargination is much wider than deep. Width of anterior lobe of sternum at epi-hyosternal suture, four inches.

Upper bed of Cretaceous Green sand, New Jersey.

ADOCUS AGILIS, Cope.

Geological Survey of New Jersey, App. C. p. 734.

Represented chiefly by an almost complete plastron from the excavations of the West Jersey Marl Company, in the upper bed of the upper Cretaceous Green Sand of New Jersey.

This specimen belonged to an individual of larger size than any heretofore referred to the genus, and one characteristically ornamented by a peculiar sculpture.

The extremities of both lobes are broken off; the margin of the posterior is thinned out, and carries an acuteness of edge to the inguinal notch where the margin is quite thick. The outline of the caudal scuta is very convex anteriorly; that of the femorals is gently convex towards the

front. The suture between the hypo- and xiphisternals is nearly transverse below; on the upper face it sends a process into the hyposternals forwards, which is acuminate; the hyposternals send a marginal process backwards beyond the line of the median suture, which is squarely truncate; its outer edge is the margin of the bone. The impressions of contact of the pubes are well marked; they are strongly incurved, and are not very different from those seen in Cistudo. The bridge of the plastron is preserved, and furnishes attachment for three marginal bones; perhaps fractions of others also. The suture between the abdominal and humeral scuta is convex backwards, and unites with an inner angle of the anterior of the intermarginal series of the bridge. There are three in the latter series, all longer than broad, but the middle one relatively much narrower than the others, as it is six times longer than wide, with parallel sides. That anterior to it is more hexagonal and wider, presenting an angle inwards for union with the suture between the abdominal and humeral scuta.

About half the mesosternal bone is preserved. It is a transverse diamond with truncate extremities. Its posterior angle is therefore very open, but is not rounded. No suture bounding either humeral or gular scuta is visible on it; the anterior angle is broken away. The anterior portion of the episternal bone preserved has a regular convex outline, and is quite thin.

The sculpture of the inferior surface is a slight imitation of that seen in some species of Trionyx. It is closely shallow-punctate, or like small rain-drop impressions. These are irregularly distributed on the anterior part of the plastron, and on the posterior lobe in obliquely decussating series.

Measurements.

	M. M.
Width of plastron at bridge,	0.2879
Length between mesosternum and xiphisternum,	0.21
Width posterior lobe at inguinal notch,	0.1835
" mesosternum,	0.091
Length "	0.0695
" hyosternum medially,	0.09
Thickness " "	0.012
" " at marginal suture,	0.007
Length abdominal suture,	0.1063
" femoral "	0.087
Length median intermarginal suture,	0.0825
Width " " "	0.015
Estimated length plastron,	0.45
" " carapace,	0.56

This species, the largest of the genus, is found in the upper green sand bed of the upper Cretaceous of New Jersey. The specimen from which the above description was taken, was found by my friend I. C. Voorhees, in the pits of the New Jersey Marl Company, and by the permission of the latter submitted to the writer.

ON THE PERIODS OF CERTAIN METEORIC RINGS.

By Daniel Kirkwood.

I. The Meteors of April 20th.

In the *Astronomische Nachrichten*, No. 1632, Dr. Weiss called attention to the fact that the orbit of the first comet of 1861 very nearly intersects that of the earth, in longitude 210°; the point passed by the latter at the epoch of the April meteoric shower. A relation between the meteors and the comet, similar to that recently detected between the November meteors and the comet of 1866, was thus suggested as probable. Is this hypothesis in harmony with facts? and if not, are our present data sufficient for determining with any reasonable probability, the true period of the April meteors?

Dates of the April Shower.—Professor Newton selects the following from Quetelet's Catalogue as belonging to this period :*

1.	B. C. 687,	4.	A. D. 1093,	'4	'5, and '6
2.	" 15,	5.	" 1122,	'3	
3.	A. D. 582,	6.	" 1803,		

Period of the First Comet of 1861.—The elements of this body were computed by Oppolzer, who assigned it a period of 415 y.4. Now while it is true that the interval from B. C.. 687 to A. D. 1803, is very nearly equal to 6 periods of 415 years, the slightest examination will show that this period does not harmonise with *any of the intermediate dates*. This fact, then, without further discussion, seems fatal to the hypothesis that the period of the meteors is nearly equal to that of the comet.

What is the probable period of the ring?—The showers of 1093—6 and 1122—3 at once suggest a period of from 26 to 30 years. The nodal passage of the densest portion of the ring at the former epoch may be placed any where between 1093 and 1096, and that of the latter, in either 1122 or 1123. The entire interval from B. C. 687 to A. D. 1803 is 2490 years, or 88 periods of 28 y.295 each; and the known dates are all satisfied by the following scheme :

B. C.	687 to	B. C.	15....672.000	years=24	periods of	18,000y	each.
"	15 to	A. D.	582....597.000	" = 21	"	28.429	"
A. D.	582 to	"	1093.714...511.714	" = 18	"	28.429	"
"	1093.714 to	"	1122.143....28.429	" = 1	"	28.429	"
"	1122.143 to		1803...680.857	" = 24	"	28.369	"

These coincidences indicate a period of about $28\frac{1}{3}$† years, corresponding to an ellipse whose major axis is 18.59. Hence the distance of the aphelion is very nearly equal to the mean distance of Uranus. It will also be observed that the time of revolution, which seems to have been somewhat lengthened about the Christian era, was previously one-third of the period of Uranus.

II. The Meteors of December 11th—13th.

In the catalogue of Quetelet we find the four following extraordinary displays which belong undoubtedly to this period. Observations made in

*Silliman's Journal for July, 1863.

† Herrick assigned a value of 27 years. See Silliman's Journal for April, 1841, p. 365.

England, 1862, indicate also a more than ordinary number of meteors at the December epoch in that year.

1. A. C. 901. "The whole hemisphere was filled with those meteors called falling stars, the ninth of Dhu'lhajja, (288th year of the Hegira) from midnight till morning, to the great surprise of the beholders, in Egypt."—*Modern part of the Universal History*, 8vo. Vol. 2, p. 281. Lond. 1780. The date of this phenomenon corresponds to the December epoch, A. D. 901.

2. 930. "Averse remarquable d'ètoiles filantes en Chine."

3. 1571. "On vit à Zurich 'du feu tomber du ciel' ".

4. 1830, 1833, and 1836. The maximum seems to have occurred in 1833, when as many as ten meteors were seen simultaneously. "Dans la nuit du 11 au 12 décembre, on vit, à Parme une grande quantité d'étoiles filantes de différentes grandeurs, qui se dirigeaient presque toutes avec une grande vitesse vers le SSE. A 10 heures et $\frac{1}{4}$, entre les seules constellations du Bélier et du Taureau, on en compta environ une dizaine."

5. (Doubtful.) 1861, 1862, and 1863. Maximum probably in 1862. The meteors at this return were far from being comparable in numbers with the ancient displays. The shower, however, was distinctly observed. R. P. Grey, Esq., of Manchester, England, says the period for December 10th—12th was, in 1862, "exceedingly well defined."*

These dates indicate a period of about $29\frac{1}{3}$ years. Thus:

901 to 930..... 1 period of 29.000 years.
930 to 1571.....22 periods of 29.136 years.
1571 to 1833..... 9 periods of 29.111 years.
1833 to 1862..... 1 period of 29.000 years.

III. The Meteors of October 15th—21st.

The showers of the following years (see Quetelet's Catalogue) belong to this epoch:

1. 288. "Apparition en Chine."

2. 1436 and 1439. In each year a remarkable apparition was observed in China.

3. 1743. (Quoted from Herrick, in Silliman's Journal for April, 1841.) "A clear night, great shooting of stars between 9 and 10 o'clock, all shot from S. W. to N. E. [Qu. N. E. to S. W.?] One like a comet in the meridian very large, and like fire, with a long broad train after it, which lasted several minutes; after that was a train like a row of thick small stars for twenty minutes together, which dipt N."

4. 1798. "Brandès marque, à Goettingue, un grand nombre d'étoiles filantes dans les observations simultanées qu' il fait avec Benzenberg."

These dates indicate a period of about $27\frac{1}{2}$ years:

288 to 1439.....42 periods of 27.405 years each.
1439 to 1743.....11 " 27,636 "
1743 to 1798..... 2 " 27.500 "

If these periods are correct, it is a remarkable coincidence that the aphelion distances of the metoric rings of April 18th—20th, October 15th—21st, November 14th, and December 11th—13th, as well as those of the comets 1866 I, and 1867 I, are all nearly equal to the mean distance of Uranus.

*Silliman's Journal for May, 1863, p. 461.

CONTRIBUTIONS TO A GRAMMAR OF THE MUSKOKEE LANGUAGE.

By D. G. Brinton, M. D.

1. Historical notes on the language, its dialects, affinities, and literature.
2. The Alphabet.
3. Remarks on Buckner's "Maskώke Grammar."
4. The Muskokee verb.
5. Specimen of the language.

I. Historical Notes.

The Muskokees, (*este muskókee*, or *muskokvl'ke*), or, as they were called by the English settlers, the Creeks, when first known to Europeans, occupied most of the territory now embraced in the states of Georgia, Alabama, and Florida. They were divided into a number of towns, each governed by a civil ruler, the *mekko* or king, and a war-chief, and all subject to one potentate, in whose family the supreme power was hereditary in the female line.

Their geographical position brought them early into contact with the white race, and many Muskokee names are preserved in the ancient Spanish narratives. Most of these, when given the Spanish pronunciation, are still intelligible to the natives, and some of the town names are those of towns (*i. e.*, bands), still in existence. The narratives of De Soto's expedition (1539-40) contain many such, and the town of Tocobaga, mentioned by Hernando d' Escalante Fontanedo,[1] who was wrecked on the coast of Florida in 1552, is still found among the Creeks in the Indian territory. The latter writer lived several years among the natives, and gives a word or two of their language. One of these, *se-le-tega*, which he translates "run to the look-out," I repeated, with the Spanish pronunciation, to Mr. S. W. Perryman, Speaker of the House of Warriors of the Creek Nation, an educated and intelligent native, without informing him of its alleged meaning. He at once translated it "run thither," the look-out being probably intimated by a gesture. Other Muskokee words given by Fontanedo are: Otapali, properly oti palin, ten islands; and Tampa, properly timpe, near to it.

In the year 1570, Juan de la Vandera, a Spanish officer at the post of St. Helena, north of the Savannah river, sent a detachment inland to seek the town of Coosa, mentioned in such extravagant terms by the survivors of De Soto's expedition. The report of this exploration has been published by Mr. Buckingham Smith in his "Colleccion de Documentos sobre la Florida." It contains the names of a number of native villages. These I read to Mr. Perryman, who promptly identified several of them, as Ahoya, two-going; Ara-uchi, a place where a tree named ara grows; Gwataro, properly coahtari, dry cane; Issa, deer; Satapo, properly satape, persimmon tree; Solameco, properly solv mekko, buzzard king; Tasqui-

[1] Memoir of Hernando d' Escalante Fontanedo. Translated by Buckingham Smith, Washington, 1854.

qui, a town still in existence; Coosa, the Cherokee name of the Creek nation.

The missionary labors of the Spanish Jesuit and Dominican ecclesiastics were in all probability partially among the Creeks, especially those of Father Juan Rogel.[2] We know that vocabularies and grammars were prepared by these devoted men, all remnants of which, so far as they relate to the Muskokee tongue, are lost.

I must not overlook one extremely valuable linguistic memorial brought to light by Mr. Buckingham Smith. It is a letter written in the Apalache dialect of Florida in the year 1688, and republished by Mr. Smith in facsimile. The word Apalache, in Choctaw Apvlvchi (v=ă short), means to help, helping, or helpers, and Apalachic' ola, apvlvchokla, is allies, literally, helping people. An examination of the letter shows that it is in a dialect closely akin to the modern Hitchitee, which is one of the branches of the Muskokee.

The Muskokee has several dialects, the most important of which are the Main Creek, or Muskokee proper, and the Hitchitee. These two differ so much that a native accustomed only to the one cannot understand the other. The words are largely the same, and when they differ, usually correspond in the number of their syllables. It is in accent, terminations, permutation of consonants, and change in quantity of the vowels, that most of the variations seem to consist. Between these two, the Alibama and Coösady dialects intervene, both partaking more closely of Hitchitee than of Main Creek. The Seminole language of Florida is not distinct from the Main Creek, as has so often been stated; not more, Mr. Perryman informs me, than the English of New England differs from that spoken in the southern states. There are, however, Seminoles who speak Hitchitee, and others Mikasuke, a dialect akin to Hitchitee.[3]

The latter, in what it differs from Main Creek, approaches the Chikasaw, which is a dialect of Choctaw?[4] The difference between Hitchitee and Choctaw is not greater than between Hitchitee and Muskokee. This whole group of tongues, which has been denominated the CHAHTA-MUSKOKEE group, does not show greater diversity among its members, than the Romanic group of Aryan tongues. This affinity is often of advantage in studying their grammatical structure, as I shall have occasion to point out, relying for the Choctaw on the unpublished "*Grammar of the Choctaw Language*," of the late Rev. Cyrus Byington, which extremely valuable work has been in my hands.

The Muskokee was probably reduced to writing the first of any of the

[2] "The people among whom Roger [Rogel] and Villareal now [1566] began their mission, were evidently a branch of the Creeks."—Shea, *Hist. of the Cath. Missions among the Ind. Tribes of the U. S.*, p. 57. The later labors of Father Rogel, on the "Rio Dulce," were not among the Cherokees, as Shea supposes, (p. 59,) but still with the Creeks, as appears evident on examining Rogel's original letters, contained in the rare work of Alcazar, *Chrono-historia de la Comp. de Jesvs en la Provincia de Toledo*. I published a translation of these letters in *The Historical Magazine*, Nov., 1861, p. 327.

[3] For specimens of Mikasuke and Hitchitee, see *The Historical Magazine*, Aug. 1866, p. 229. The latter is also called Chelokee. The geographical names Okee-chobee, Okee finokee, etc., are Hitchitee, and not Main Creek.

[4] The Choctaws and Chikasaws can readily understand each other.

aboriginal tongues north of Mexico. In 1562, René Laudonnière, coasting among the sea-islands between the mouths of the Savannah and St. John rivers, collected a vocabulary, which unfortunately he did not think of sufficient interest to insert in his narrative.[5] Father Rogel applied himself with success both to the words and structure of the tongue,[6] but his manuscripts are not known to be in existence. Consequently, the earliest specimens of Muskokee proper, except the few words given by Fontanedo, date after the settlement of the colony of Georgia by the English. The Moravian missionaries who settled at Ebenezer, near Savannah, attempted to study the language in order to use it in converting the natives. Their success was poor, though they collected a number of words. In writing them they used the Greek alphabet, as better adapted to express the native sounds. Hence we find in their reports such strangely familiar-looking words, as *τυτκα* fire, properly tvtke, *άσσε* sun properly hasse, *σιλλαπάιχα* shoe, etc.[7] The use of the accents in their vocabularies is one advantage over the modern alphabet. I believe, however, no translation was ever published in this character, and the missionaries soon became discouraged in their proselytizing efforts.

The first printed books in Muskokee, which I have been able to find, were published in 1835. One of them is a translation of the Gospel of John, by the Rev. John Davis; the other a duodecimo tract of 35 pages, entitled:

A short sermon: also hymns, in the Muskokee or Creek language, by Rev. John Fleming, missionary of the American Board of Commissioners for Foreign Missions (Boston, 1835).

Since that date a number of religious and educational works have appeared, the titles of some of which in my possession I add:

Nakcokv Setempohetv. Introduction to the shorter Catechism, translated into the Creek language by Rev. R. M. Loughridge, A. M., and Rev. David Winslett. Second edition, revised and improved. Presbyterian Board of Publication, Phila., 1858, 12 mo., pp. 34.

Nakcokv es Kerretv Enhvteceskv. Muskokee or Creek First Reader, by W. A. Robertson, A. M., and David Winslett. Second edition. New York, 1867, 12 mo., p. 48.

Nakcokv esyvhiketv. Muskokee Hymns, collected and revised by Rev. R. M. Loughridge, A. M., and Rev. David Winslett, interpreter. Fourth edition, revised and enlarged by Rev. W. S. Robertson, New York, 1868, 12 mo., pp., 221.

Cesus oh uyares. I will go to Jesus. Translated into Creek by Thos. Perryman and Mrs. A. E. W. Robertson, Tullahassee Mission, American Tract Society, no date: 12 mo., pp., 23.

A Grammar of the Mask*ώ*kee or Creek Language, to which are prefixed lessons in spelling, reading, and defining. By H. F. Buckner, a mission-

[5] He says: "mettant par escrit les termes et locutions indiénnes, jé pouvois entendre la plus grande part de leur discours." *Hist. Notable de la Floride*, p. 29.

[6] He says: "In six months I was able to speak and preach in it." *Letter of 9th Dec.*, 1570. These early students, to take them at their word, must have had more linguistic talent than our generation is favored with.

[7] Urisperger, *Nachrichen*, *Anno* 1734.

ary under the patronage of the Domestic and Indian mission board of the Southern Baptist Convention. Assisted by his interpreter, G. Herrod, superintendent of public instruction, mecco Creek nation, etc. Published by the Domestic and Indian mission board of the Southern Baptist Convention, Marion, Alabama, 1860, 8 vo. pp. 139.

Messrs. Buckner and Herrod also published a translation of the Gospel of John, and Mrs. Robertson, a translation of a tract on the Sabbath. The Laws of the Nation and various other works have likewise appeared. The Nation, I may here state, numbers about 14,000 souls, and about one-half of the male population can read, so it is of considerable importance that the structure of the language be ascertained.

II. The Alphabet.

The need of a uniform alphabet for American tongues is nowhere more vividly shown than in Muskokee. More than one-half of the limited literature I have above mentioned is unintelligible to educated natives on account of the discordant alphabets used. Not less than *five* different ones have been devised. That now generally adopted and certainly best adapted for practical utility to the Nation, is based upon the English sounds of the letters. It was agreed to by many interpreters and chiefs at the Old Agency, in 1853, and has been introduced in all printed works since, except those of Messrs. Buckner and Herrod. It contains thirteen consonants, and six vowels. The vowel sound of a in *fate*, the sound th, and the consonants b, c, d, g, j, r, q, v, x, and z, are wanting, although in the Hitchitee dialects the b occurs. The remaining consonants are given their English values, and the letters r and c are introduced to represent sounds not in our tongue. The r is an aspirated l, slightly guttural, quite similar to the Welsh ll. The c is pronounced tch, soft, as in *wretch*. The w is always surd, as in *we*, *weak*. The vowels are:

a the Italian or Spanish a.
e as in *me*.
i as in *pine*.
o as in *note*.
u as in *wood*, or *rule*.
v represents the neutral vowel, and is really ă short. No accents are used, although both accents and signs of quantity should be employed to express the language correctly. No nasals are provided for, although very soft nasals do occur, and are represented in Mr. Fleming's alphabet by diacritical marks, and in that of Mr. Buckner by the Spanish ñ following the vowel.

The absence of sonant letters and of decided nasals is the chief difference between this and the Choctaw alphabet, and explains much of the apparent diversity between the two tongues. Thus the Choctaw sinti, snake, becomes in Muskokee ceto, the sonant being changed to its surd, and the nasal dropped; Ch. shakba, arm, shortens the first vowel to v, and permutes the labial, becoming Mus. svkpa; and again Ch. iubi becomes Mus. hufi, thigh.

Mr. Fleming gives two sounds to a, one as in father, the other as in wash; e as a in paper; i as ee in meet; ai as i in pine; and represents the r by hl, Of course this materially alters his orthography.

Mr. Buckner makes use of the Agency alphabet, with these changes: ch for c; i as in pin; ii as i in pine; u as in rule; o as in not; the Greek ὠ for o as in go; θ as oo in took, foot. These changes, he claims, are neccessary to represent the language accurately, but both the natives and the missionaries have told me this is a mistake. There is really no such sound in Muskokee as o in not, and Buckner's error arose from the shortening effect of k after the sound of a, as in rakko, great. Furthermore, the distinction he draws between θ and u is imaginary, as he himself half confesses in a note to p. 22 of his Grammar. As his work is the only attempt ever made to display the grammatical structure of the language, it will be a service to philology to point out several serious errors into which he has been betrayed. I am enabled to do this from information furnished me by Mrs. A. E. W. Robertson, of the Tallahasse mission, who is excellent authority on the language, and from the unpublished manuscripts of the late Rev. Cyrus Byington, from which I have drawn that which relates to the Choctaw.

III. Remarks on Buckner's "Maskώkee Grammar."

Nouns. The author (p. 52) remarks that common nouns are not varied on account of number; and that names of people are pluralized by the suffix vlki. The rule should be that most nouns denoting an agent form their plural by adding lke, as pasv a sweeper, plural pasvlke; some others indicate the plural by adding take, which also forms the plural of pronouns, and in writing it is important to distinguish which word is pluralized, as the position of the suffix is in both cases the same; thus, ce wvnv take, your (pl.) sister, but ce wvnvtake, your sisters.

The declension of the noun is given by Buckner under three headings, the first form, the nominative case, and the objective case. The first form always ends in a vowel, the nom. case in t, the objective in n. The possessive case, he says, is formed by prefixing the possessive pronoun to the thing possessed. Mrs. Robertson divides the cases into nominative, possessive, objective, relative, and vocative. The nominative ends in t, but with "continual exceptions," not for euphonic but for grammatical reasons still obscure. The possessive case is the simple form of the noun, but requires the possessive pronoun after it, as it did in old English, *e. g.* "John his hat." The declensions given are as follows:

	Buckner.		Mrs. Robertson.
1st form	Cane	John	
Nom.	Canet		Canet
Object,	Canen		Canen
Possessive			Cane
Relative			Canen
Vocative			Cane.

Cane em eslafkv, John his knife.

I think that any attempt to give paradigms of Muskokee nouns in this

manner will be incorrect. Those "continual exceptions" will still remain obscure. We are so inveterately accustomed to the declensions of the Aryan tongues, and to case-endings, that we think every language must have them. Such is not the case. None of the Chahta-Muskokee tongues have anything of the kind. They express the relations of words in a sentence by a complicated but strictly regular system of particles or elementary sounds, each sound, when combined, retaining its original significance, which are called "post-positive particles" or "article-pronouns." These are divided into two classes, the definite and the distinctive, and are subject to numerous changes. They can be used with all parts of speech, and supply the place of case-endings, and modal terminations. The Muskokee terminal series t, it, et, vt, corresponds to the Choctaw at, vt, et; the objective and relative forms are the Choctaw nasals *a* and *o*; and the possessive form is the same in both tongues; *e. g.* Choc. Chan in chuka, John his house. There is still wanting an analysis of the Muskokee article-pronoun, and no grammar of the language can be drawn up correctly till this is done.

Adjectives. On the comparison of adjectives Mr. Buckner says (p. 68): "The comparative degree is formed by prefixing sin to the positive, and the superlative is formed by prefixing ri to the comparative, as cvmpe, sweet; sincvmpe, sweeter; risincvmpe, sweetest." In fact, both these latter are in the comparative degree; sin is the particle es, governing a pronoun in the relative, and the expression should read es en cvmpe, sweeter than it; the r or er prefixed to the es, simply expresses a stronger comparison, as er es en cvmpe, still better than it. The superlative is formed not by a prefix, but by the suffix mahat, in the nominative, and mahan in the oblique cases, as cvmpe mahat, sweetest.

Mr. Buckner's rule for the plural of adjectives is: "Adjectives of two syllables form their plural by inserting the contracted form of the first syllable between the two syllables of the singular," as tvphe, wide, pl. tvptvhe. This rule is very incomplete. There are in Musokee two classes of adjectives, the first closing the root with a single consonant, the second with a double consonant, or with two consonants. The first form their plural by adding vke to the root, as here, good, pl. hervke, cate, red, pl. catvke, lane, pl. lanvke. The second class form their plural by inserting the first two letters of the root between the two closing consonants, as hvlwe, pl. holhvwe, lvwke, pl. lvwlvke, svfke, pl. svfsvke, lowvcke, pl. lowvcloke. Many of this class transpose the consonants, apparently for the sake of euphony; as kocukne, pl. kocuncoke, cvfekne, pl. cvfencvke. Some of them also form their plural as those of the first-class; as yekce, pl. yekcvke, afvcke, pl. afvckvke. Some in both classes insert ho before the terminal consonant; as hiye, pl. hihoye, holwvke, pl. holwvhoke; cvpvkke, pl. cvpvkhoke. Lekwe, rotten, has two plurals, one, lekhowe, applied to animal matter, the other, leklewe, to vegetable matter.

There is also a dual of adjectives, which Buckner does not mention. It is not frequently used; cvfekne, pl. cvfencvke, dual cvfencvkvke; yekce, strong, pl. yekcvke, dual, yekcvkvke. These occur only in the second person.

Throughout Mr. Buckner's work his division of words is faulty, and adds much to the difficulty of the language. He is much too positive in his views, and his translations are frequently far from literal. His Grammar cannot be relied upon as a safe guide in any sense, and while he is deserving of much credit for his industry in collecting material, the arrangement of and the deductions from that material must be condemned.

IV. The Muskokee Verb.

The congugation of a verb in an American language is a prodigious task. In analysing the Muskokee verb I shall avoid as many complications as possible, and speak only of active verbs, in their first transitions (when the object is presumed to be always in the third person and the singular number), in their first form, and affirmative signification.

Roots. Muskokee verbs have two roots. The first is formed by dropping the termination etv of the infinitive mood, as nvfketv, to strike, root nvfk, kicetv, to tell, root kic. The second root is formed by inserting h before the final consonant of the first root, if there is but one consonant; and by inserting i between the two final consonants if they are two; and if they are the same, the latter is changed into y; *e. g.*

kicetv	1st root kic	2nd root	kihc
letketv	letk		letik
vkhottetv	vkhott		vkhotiy
merretv	merr		meriy

Moods. The ordinary form of the Infinitive ends in etv. The sign of the subjunctive is the particle omat, added after the tense sign. It corresponds to, and is probably derived from, the Choctaw subjunctive particle kmvt. The Imperative has a future as well as a present form, corresponding in this with most other American languages, and not a rare exception as Buckner thinks.

Tenses. The imperfect tense has not less than five forms. The first refers to something which has transpired to-day, the second to what transpired yesterday, the third to an occurrence usually only a few weeks ago, or, as we would say, "lately," the fourth to an action or event long since completed, but within the memory of the speaker, while the fifth imperfect, called the indefinite or historic tense, refers to transactions of which the subject of the verb has no personal knowledge, nor is directly connected with.

The future tenses are the simple, the compound, and the progressive futures. The progressive futures are formed by adding to the first and second roots the termination vran, and subjoining the tense signs of either past, present, or future tenses. They express the idea of being about to, or having been about to, perform an action, and when formed from the fifth imperfect, convey the sense of obligation or necessity. It will thus be seen that both in formation and signification they present a striking analogy to the first and second periphrastic conjugations—those from the participles in rus and dus—in Latin.

All the above tenses are formed from the first root of the verb. The perfect tense, is formed as in Latin, from the second root, by adding to it the terminations of the present.

The tense-signs are as follows :

Present, es, the e dropped in the first person singular, and lengthened in the first person plural.

Imperfect, first, is
second, vnks
third, emvtes, emvtvs, or emvts, the e dropped in the first person singular.
fourth, vntvs
fifth, vtes

Future, simple, vres, the v dropped in first sing.
compound, tares, used after the fifth imperfect with its final s dropped, *e. g.* nvfkvyvte tares.
progressive, vran added to the root.

Perfect, is, to second root, the i shortened to v when it comes before y.

Persons. The persons are indicated by inseparable personal pronouns between the root and the tense sign. They vary in the different tenses according to the following table:

Sing.	1st pers.	2nd, Pl.	1st	2nd	3d
Present, and third imp.,	i	etsk	e	atsk	ak
First, second, fourth, and fifth imp.	vỵ	etsk	ey	atsk	ak
Simple future,	a	etsk	ey	atsk	vk

The third singular is wanting.

There is a dual form of the verb when two persons or things are *spoken of*,—an objective dual, in a sense. It is formed by prefixing torkor (probably a corruption of the Choctaw tuklo, two) and making changes in the first syllable of the root, according to rules with which I am not acquainted. The pronouns remain in the singular form, as letkis I run, torkorkis we two run.

Negative form. The negative form of the verb is made by inserting the negative particle ak (Choctaw, ik), after the root, which latter may undergo euphonic changes, *e. g.* kicis, I say, kicakis, I do not say.

It was my intention to give a complete paradigm of the active, affirmative, simple verb, in the first transition, but as I am not able to exhibit this satisfactorily at present, I shall omit it. I shall therefore conclude this article by a partial analysis of a specimen sentence in the language, and a comparison of it with the same in Choctaw, thus showing the affinities of these tongues.

V. Specimen Sentence.

Acts. ch. XIV, verse 11:

And when the people saw what Paul had done, they lifted up their voices, saying in the speech of Lycaonia: The gods are come down to us in the likeness of men.

In Muskokee:

Momen estet, nake Pal momecaten hecakof em opunvkv-en-haken kvwvpa kvtes, Likeonv em punvkv ofvn, Hesake tvmese este omvket ye pun hvtvpeces, mahaket.

Translation.

Momen, and, the conjunctive particle with the terminal n, which throws the clause into the oblique case or sense.

estet, the people, compounded of este and the definite article-pronoun nominative t, literally, people the.

nake, the thing, or things.

Pal momecaten, that Paul had done.

hecakof, when they saw.

em, their.

opunvkv, word; en, its; haken, sound.

kvwvpakvtes, they lifted up, fifth imperfect.

Likeonv em punvkv ofvn, Lycaonia its language in.

Hesaketvmese, gods, from hesaketv, life, and emese, source or font, "source of life." This is the word commonly employed by the missionaries for God. Col. Hawkins, in his Sketch of the Creek Country, spells it E-sau-ge-tuh E-mis-see. Mr. Perryman tells me that it is probably a word coined by the English, and not of native origin.

este omvket, men resembling.

ye, hither, pum, to us; hvtvpeces, have descended; makaket, saying.

In Choctaw (the nasals in italics):

Mihma okla hash ot, Pal vt nana yvmihinchi na pisa mvt, Laikeonia anumpa ho okla anumpulit chitoli hosh, Chitokaka vhleha yvt hatak *o* chiyuhmit aka mintit *a*yvt hvpim vlvshke ; ahanchi tok.

Translation.

Mihma, and, with the definite oblique termination.

okla, people, hash ot, pronoun of renewed mention definite, the aforesaid ones, they.

Pal vt, Paul he; nana, the responsive pronoun definite; the thing which, what.

yvmihinchi, he had done.

na—mvt, when, pisa, they saw.

Laikeonia anumpa h*o*, Lycaonian speech the, h*o* is the distinctive article pronoun in the oblique case.

okla anumpulit hosh, the people, the aforesaid ones (hosh) spoke; chitoli, loudly.

Chitokaka, gods, vhlehay vt, they indeed, article pronoun definite.

hatak *o* to men, distinctive and oblique, chiyuhmit, resembling.

aka, below, mintit, coming toward, *a*yvt, here, "coming toward this place below."

hupim, to us; vlvshke, have come, from ula, to come.

ahanchi tok, they said. The particle tok throws the verbs into the remote imperfect tense.

The strong similarity in the construction of the two languages is very evident from these specimens.

Stated Meeting, March 18, 1870.

Present, eleven members.

MR. FRALEY, Vice-President, in the Chair.

A letter accepting membership was received from Mrs. Mary Somerville, dated Naples, Feb. 14, 1870.

Letters of envoy were received from the Royal Academies at Munich, (Dec. 1,) and Vienna, (Aug. 20,) from the R. Society of Zoology at Amsterdam, (Dec. 9,) and the Society at Giessen, Sept. 2, 1869.

Letters of acknowledgment were received from the Societies at Giessen, (77–80), Gottingen, (78–80), Bremen, (73–80), Prof. Bunsen, (78, 79), Historical Acad. at Madrid, (XIII. 1, List, Cat. I, 71, 72, 77), R. Academy at Amsterdam (78–80), R. Library, Hague, (78-80), Observatory at Prague (78–80).

A circular letter respecting the celebration of its 25th anniversary festival, on the 27th of March (April 8th), was received from the Society at Riga.

A letter was read from Captain C. F. Hall, dated Washington, D. C., March 12, 1870, enclosing a petition to Congress, in favor of his proposed Third Arctic Exploring Expedition. The petition was laid upon the table for the signature of the members and others.

Donations for the library were received from the Societies at Moscow, Emden, Frankfurt, Lille, Bordeaux, Montreal and Madison; from the Berlin Academy; Paris Geographical Society; Royal Institution of G. Britain, London; Chemical and Antiquarian Societies; Greenwich Observatory; Dublin Geological Society; Dr. Haughton; the American Antiquarian Society; New York Lyceum; Dr. Geo. B. Wood; and the Peabody Institute.

A Circular from the Smithsonian Institute announced another transmission of correspondence for the 20th April; all envoys to be in Washington by the 15th.

Prof. Cope communicated the results of his examinations of the locality, two miles S. W. from Woodbury, where from 30 to 60 skeletons, some of them women and others children,

were lately exhumed, and the greater part broken up, and spread upon compost heaps. Dr. Leidy has recovered one pretty complete skull, which he exhibited before the Academy of Natural Sciences, at its last meeting, and expressed a decided opinion in favor of its European origin. Professor Cope's opinion was equally confident, that the remains were those of no aboriginal Indian race. Professor Trego suggested that they belonged to that early Finnish or Swedish Colony, which attempted a settlement on the banks of the Delaware, a short while previous to the arrival of the Hollanders and Quakers, under William Penn. The bodies were all taken from a shallow trench, not more than 8 feet wide by 16 long; they had been laid in two tiers or stages, one above the other, and there was no relic, ornament, tool, weapon, or fragment of clothing, to suggest relationship to any age or race; and no appearance of a tumulus.

Prof. Cope exhibited three large photographic pictures of figures of the human foot incised in upper cretaceous red sandstone, near Topeka, thought by western men to be fossil impressions. The shadows in the photographic copies showed plainly the nature of the marks, for the ball of the great toe was an elevation, instead of a depression, and the cutting was carried round the ends of the intervals between the toes. A discussion of the use of the foot in aboriginal picture writing followed.

Dr. Carson recalled the exhibition of a sculptured rock, showing rivers and game, a sort of guide map, taken from the Susquehanna River banks, by Prof. Walter R. Johnson, at the Academy of Nat. Sciences or Historical Society, about 1836 or 1837, and expressed his desire that it should be re covered for use, in comparison with later discoveries.

Dr. Brinton being questioned as to the amount of credence to be given to Baron De Waldeck's alleged Elephant or Mastodon figures, supposed to be recognisable among the hieroglyphics of Mexico, replied that he had had the opportunity of examining M. Charancy's photographs, and agreed with the latter, that no such figures could be made out from the

original designs, but that the figures in question were symbolically compounded of man and serpent, and appear as such in MSS. recently published by the French government.

Mr. Lesley instanced the mammoth, etched on a plate of ivory, found in a cave in France, to clear away any serious improbability from the way of supposing a like physical reminiscence of the Mastodon in this country. He referred, also, to the fact, that the Ancient Egyptian B was graphically represented by the human leg, A by the arm, T by the hand, and that what is called the comb, may have been meant for the foot-mark. In the earliest stage of human life the foot and the foot-print were of superior importance to the hand and its work. But in the second stage of aboriginal life, the hand took precedency of the foot, as symbol of force and skill, combining thought with feeling, the reasoning power with the instinct. It soon entered into the synod of symbolic gods, with its fingers, and obtained a special worship for its hand-print.

Dr. Coates related the origin of the Arabic cyphers on the hypothesis, that they were constructed by posturing with the hands and fingers, singly and in combination.

Pending nominations 649—656 were read.

The following communication was read:

Office of the Commissioners of Fairmount Park, No. 224 S. Fifth Street, Philadelphia, March 12th, 1870.

At a meeting of the Commissioners of the Park, held this day, the following preamble and resolutions were adopted:

WHEREAS, The American Philosophical Society has made a communication to this Commission, proposing that the name of André François Michaux, who travelled long in this country, and described our Oaks and forest trees, in a work of great merit and splendor, should have his name, and that of his father (who had, by like travel and study, rendered service to science), honored in the Fairmount Park, in a manner to be a memorial to their devotions, and to promote the objects which had occupied their lives, and has proposed, after the death of the widow of André François Michaux, to devote the interest or income of six thousand dollars bequeathed by him to said Society, to be expended in execution of the trust of his will in the said Park, for the purpose following. Therefore,

Resolved, That there shall be a grove of Oaks in the Fairmount Park forever to bear the name of "The Michaux Grove," in which, if practicable, shall grow two oaks of every kind that will endure the climate.

Resolved, That any surplus of revenue received by the Commission from

the Michaux Fund, after satisfying the requirements of the preceding resolution, shall be devoted to the cultivation of Oaks of every variety capable of cultivation in our climate, in the Park nursery, which Oaks, to the extent of two of each kind cultivated, be hereafter distributed to other Public Parks in the United States, under proper regulations to be hereafter prescribed.

Attest, DAVID F. FOLEY, Sec. Park Commission.

On motion of Mr. Price, it was then

Resolved, That this Society do agree to the terms contained in the preamble and resolutions of the Fairmount Park Commissioners, adopted on the 12th day of March, 1870, in the expectation and confidence that the planting of the Michaux Grove of Oaks may be soon commenced, so that the Grove shall early become one of the attractions of the Park.

And the Society was adjourned.

COMPARISON OF MECHANICAL EQUIVALENTS.

BY PLINY EARLE CHASE.

Read January 7, 1870.

The comparison of different mechanical equivalents will open a new field for investigation, which may prove to be fertile in valuable results. For example, recent determinations, by the different methods of Thomsen and Farmer, fix the mechanical equivalent of light, in a wax candle burning 126½ grains per hour, at 13.1 foot-pounds per minute, the equivalent of 1 grain being 6.213 foot-pounds. According to Dulong, the heat evolved, during the combustion of 1 grain of olive oil in oxygen, is sufficient to heat 9862 grains of water 1° C. According to Favre and Silbermann, 1 grain of oil of turpentine, burned in oxygen, would heat 10,852 grains of water 1° C.

It may therefore be presumed that the total heat given out by the combustion of 1 grain of wax, is about sufficient to raise 10,000 grains of water 1° C., or 18,000 gr. 1° F. This represents a mechanical equivalence of ($18{,}000 \times 772 \div 7000 =$) 1985.143 foot-pounds, which is 319.5 times as great as the corresponding equivalent of the light given out during the combustion.

Tyndall, in his lecture on Radiation, states that the visible rays of the electric light contain about one-tenth of the total radiated heat. The relative luminous intensity of an electric lamp would therefore appear to be about 32 times as great as that of the wax candle. This ratio so nearly resembles that of solar to terrestrial superficial attraction, and the connection of electric and magnetic currents with solar radiation is so evident, that additional experiments, to furnish materials for a great variety of similar comparisons, seem desirable. While it is possible that the resemblance, in the present instance, may be accidental, the numerous harmonies between the manifestations of cosmical and moecular forces, render it at least equally possible that it may have a weighty significance.

MONTHLY VARIATIONS OF RAINFALL AT PHILADELPHIA.

By Pliny Earle Chase.

Read Feb. 4, 1870.

The following Tables may be of service in the study of secular rainfall. The Normals, in Table II. were computed from the observations of seven successive years, in the same manner as those in my previous discussions.

I. Monthly Rainfall at Philadelphia, for Forty-five Years.

	Jan.	*Feb.*	*Mar.*	*Apl.*	*May.*	*June.*	*Jul.*	*Aug.*	*Sep.*	*Oct.*	*Nov.*	*Dec.*
1825	.84	3.26	4.63	.83	1.72	3.59	2.06	3.70	2.61	1.25	1.36	3.72
1826	1.11	2.13	5.80	3.87	.19	4.65	3.68	2.75	2.00	5.83	1.85	1.28
1827	2.86	3.55	1.23	2.83	2.50	2.09	2.97	5.75	.79	5.91	4.76	3.26
1828	2.05	2.75	3.35	3.82	3.49	2.69	5.33	1.51	4.62	1 39	6.71	.26
1829	5.37	3.75	2.87	4.99	2.68	3.44	4.35	4.61	2.01	2.30	3.97	1.51
1830	1.63	2.06	4.11	1.82	3.75	5.99	4.07	3.87	2.93	4.31	5.35	5 18
1831	6.02	2.44	3.17	5.20	1.07	3.56	4.17	5.39	5.33	4.51	1.88	1.20
1832	4.58	2.66	1.90	2.98	5.40	1.55	2.62	5.69	1.40	3.41	2.59	5.09
1833	3.97	1.24	2.22	.70	5.88	5.28	4.15	3.39	3.82	10.05	2.18	5.67
1834	2.49	2.22	2.02	2.83	3.52	3.99	4.35	.62	3.57	3.29	3.01	2.33
1835	2.75	1.81	3.83	4.33	1.99	6.27	6.55	2.05	2.63	1.22	3.19	2.68
1836	7.62	2.99	1.75	3.47	2.28	7.31	2.91	1.97	1.82	3.59	3.34	3.61
1837	2.50	3.58	3.76	2.84	4.83	2.83	5.89	4.06	2 28	.66	3.23	2.53
1838	2.20	2.19	3.17	3.59	3.58	6 60	2.38	2.78	9.52	4.90	3.35	1.04
1839	5.04	3.42	1.50	1.51	6.07	3.92	2.52	4.64	2.92	2.83	3.10	6.26
1840	1.84	3.01	2.63	6.83	2.69	5.95	4.54	5.55	2.50	5.73	2.49	3.65
1841	7.84	1.39	5.82	6.46	3.27	3.11	3.28	9.10	1.90	3.20	4.22	5.92
1842	1.36	4.26	2.84	5.31	5.86	3.19	11.80	3.79	1.27	1.71	3.49	3.66
1843	1.44	2.54	4.41	4.72	2.04	1.69	4.54	9.25	4.86	3.22	4.15	4.04
1844	4.05	1.45	4.43	1.35	3.09	3.35	5 28	2.40	4.03	5.02	2.95	2.75
1845	3.76	4.74	2.42	2.58	1.60	3.72	2.76	7.30	2.16	2.53	2.50	3.93
1846	4.63	3.33	4.60	2.11	3.44	3.30	4.60	4.27	.25	2.44	7.97	3.44
1847	4.73	4.57	4.70	.59	1.57	3.30	2 76	3.18	8.07	3.00	2.84	5.78
1848	2.03	1.44	2.76	1.54	4.90	4.43	3.28	1.71	1.81	3.74	2.34	5.01
1849	.73	2.61	5 47	1.75	3.99	2.20	2.93	6.97	1.40	5.59	2.60	5.84
1850	4.77	2.87	4.75	2.66	6.50	2.03	5.97	8.33	7.73	1.09	3.32	4.51
1851	1.23	3.11	3.47	4.56	4.82	3.44	2.52	2.56	1.13	3.02	3.35	2.27
1852	2.01	2.71	4.27	6.44	3.03	4.03	4.05	4.40	1.29	2.27	6.05	5.17
1853	1.85	4.44	2.46	3.83	5.17	1.10	6.30	3.09	4.46	3.47	2.32	2.17
1854	2.33	4.20	1.62	7.75	6.93	2.39	3.02	.84	3.80	1.55	2.83	2.91
1855	2.34	2.35	1.68	2.05	2.96	7.95	6.40	2.79	4.00	4.11	2.04	5.42
1856	4.54	1.24	2.23	3.51	2.69	1.99	1.51	6.00	4.01	1.30	2.07	2.94
1857	3.53	.79	1.83	6.79	5.55	7.50	3.91	7.59	1.11	2.69	1.45	5.55
1858	2.59	2.29	1.09	4.64	5.01	4.59	1.35	4.94	1.49	1.84	5.61	4.59
1859	6.67	3.66	6.98	5.61	2.25	6.01	4.07	4.74	7.68	3.13	3.82	3.49
1860	3.22	2.75	1.42	3.80	3.82	2.88	.99	8.40	2.85	4.52	6.13	3.31
1861	5.24	2.07	3.92	3.71	6.64	3.88	2.56	3.14	4.40	3.80	4.87	2.09
1862	4.79	4.64	3.55	4.16	2.31	6.97	2.46	.93	3.98	4.77	4.79	1.65
1863	4.72	4.68	5.88	7.01	4.51	4.25	6.01	1.45	.88	2.46	2.70	4.63
1864	1.70	.55	5.17	3.80	8.68	2.35	3.77	1.92	7.16	1.82	3.93	5.14
1865	3.61	5.82	4.71	2.83	7.21	4.75	2.97	3.77	7.96	3.05	3.96	5.61
1866	3.15	6.61	2.15	2.93	4.68	2.95	2.52	2.18	8.70	4.14	1.76	3.47
1867	1.70	3.89	5.46	1.81	7.32	11.02	2.39	15.82	1.72	4.32	2.94	2.73
1868	3.62	2.52	3.36	5.44	7.00	4.37	3.51	2.67	8.91	1.74	5.28	3.60
1869	4.28	4.66	5.30	2.12	4.24	5.58	2.80	1.28	3.25	6.32	3.73	5.91

II. Monthly Normals of Rainfall at Philadelphia, for 40 Years.

	Jan.	*Feb.*	*Mar.*	*Apl.*	*May.*	*June.*	*Jul.*	*Aug.*	*Sep.*	*Oct.*	*Nov.*	*Dec.*
1828	2.94	3.06	3.06	3.66	2.73	3.25	4.21	3.66	2.69	3.41	4.86	1.88
1829	3.47	2.95	3.18	3.74	2.96	3.74	4.34	3 87	3.03	3.18	4.75	2.26
1830	3.91	2.69	3.24	3.65	3.01	4.01	4.12	4.36	3.28	3.64	4.03	2.91
1831	4.28	2.41	2.95	3.39	3.39	3.79	3.81	4.71	3.33	4.44	3.20	3.50
1832	4.28	2.17	2.53	2.90	4.07	3.64	3.71	4.36	3.26	5·22	2.67	3.97
1833	3.86	2.00	2.36	2.56	4.31	4.07	4.04	3.33	3.17	5.35	2.61	4.01
1834	3.62	2.03	2.50	2.81	3.76	4.89	4.55	2.33	3.05	4.39	2.84	3.56
1835	3.94	2.34	2.72	3.28	3.13	5.50	4.78	2.07	2.83	3.12	3.09	3,09
1836	4.19	2.70	2.87	3.41	3.18	5.53	4.56	2.48	3.05	2.52	3.23	2.86
1837	3.87	2.92	2.89	3.24	3.75	5.26	4.07	3.10	3.98	2.72	3.26	2 83
1838	3.51	2.94	2.78	3.28	4.23	5.04	3.57	3.79	4.66	3.30	3.20	3.20
1839	3.64	2.86	2.80	3.93	4.25	4.89	3.50	4.74	4.16	3.83	3.15	3.95
1840	3.99	2.77	3.22	4.96	4.01	4.49	4.26	5.79	3.02	3.90	3.25	4.53
1841	3.91	2.75	3 77	5.52	3.89	3.80	5.64	6.42	2.41	3.47	3.50	4.58
1842	3.28	2.80	4.01	5.10	3.74	3.11	6.53	6.41	2.86	3.12	3.66	4.23
1843	2.91	2.81	3.98	4.01	3.29	2.84	6.14	6.02	3.16	3.23	3.61	3.80
1844	3.23	2.95	3.85	2.93	2.78	3.01	5.00	5.57	3.19	3.39	3.67	3.58
1845	3.84	3.36	3.80	2.22	2.54	3.30	4.10	5.09	2.93	3.18	4.08	3.75
1846	4.05	3.58	3.92	1.78	2.67	3.46	3.65	4.43	3.11	2.96	4.34	4.25
1847	3.61	3.30	4.07	1.51	3.11	3.47	3.42	3.91	3.50	3.26	3.89	4.83
1848	2.88	2.81	4.21	1.59	3.71	3.29	3.44	4.26	3.58	3.61	3.16	5.13
1849	2.49	2.61	4.37	2.15	4.30	2.96	3.72	5.22	3.57	3.52	2.94	4.94
1850	2.42	2.74	4.34	3.12	4.78	2.84	3.97	5.51	3.51	3.02	3.30	4.37
1851	2.28	2.99	4.00	4.22	4.77	2.93	4.09	4.77	3.12	2.66	3.78	3.84
1852	2.06	3.33	3.42	5.00	4.65	2.92	4.31	3.71	2.89	2.62	3.87	3.52
1853	2.08	3.58	2.74	5.21	4.82	2.99	4.58	2.92	3.25	2.67	3.39	3.41
1854	2.41	3.31	2.16	4.90	4.76	3.61	4.54	2.78	3.70	2.67	2.74	3.57
1855	2.92	2.53	1.92	4.45	4.29	4.45	4.09	3.64	3.64	2.58	2.31	3.94
1856	3.41	1.81	1.94	4.49	4.04	5.00	3.45	4.99	3.12	2.42	2.34	4.27
1857	3.72	1.70	2.22	4.94	4.17	5.26	2.93	5.80	2.84	2.36	2.94	4.41
1858	4.05	2.17	2.84	5.13	4.14	5.22	2.66	5.88	3.30	2.63	3.86	4.23
1859	4.41	2.66	3.40	4.83	3.99	4.82	2.47	5.71	4.06	3.19	4.64	3.72
1860	4.62	2.92	3.55	4.41	4.11	4.48	2.36	5.16	4.27	3.74	4.99	3.08
1861	4.66	3.19	3.68	4.35	4.35	4.59	2.61	3.86	3.92	3.94	4.84	2.74
1862	4 45	3.47	4.20	4.66	4.65	4.74	3.31	2.46	3.67	3.64	4.34	3.04
1863	3.92	3.53	4.75	4.94	5.41	4.41	3.89	1.93	4.22	3.08	3.84	3.89
1864	3.33	3.74	4.78	4.57	6.33	4.01	3.81	2.41	5.59	2.81	3.53	4.57
1865	3.00	4.36	4.34	3.61	6.64	4.33	3.26	3.81	6.64	3.09	3.26	4.55
1866	2.87	4.74	4.02	3.02	6.48	5.39	2.84	5.73	6.55	3.50	3.12	4.02
1867	2.93	4.42	4.08	3.11	6.33	6.24	2.80	6.61	5.87	3.70	3.41	3.73

Table I. indicates the following probabilities:

1. Of a *change* of weather (from a preceding wet month, or season, to a dry one, or *vice versa*).

In September,	$\frac{3}{5}$	In Autumn,	$\frac{8}{15}$
" November,	$\frac{5}{9}$		
" January,	$\frac{6}{11}$		
" April,	$\frac{8}{15}$		

2. Of a *continuance* of the weather of the preceding month or season.

In January,	$\frac{5}{9}$	In Winter,	$\frac{9}{14}$
" February,	$\frac{6}{11}$	" Summer,	$\frac{3}{5}$
" October,	$\frac{8}{15}$	" Spring,	$\frac{8}{15}$
" December,	$\frac{8}{15}$		

The indicated probability, nearly $\frac{5}{9}$, that a rainy February will be followed by a dry Summer (June to October, inclusive), and *vice versa*, is very curious.

Stated Meeting, April 1st, 1870.

Present, eleven members.

PROF. CRESSON, Vice-President, in the Chair.

Letters accepting membership were received from Carl Fr. Naumann, dated Leipsic, 13th February, 1870; George Ritter Von Frauenfeld, Wien, 5th March, 1870; Prof. Dr. F. V. Hochstetter, Wien, 2d March, 1870; Louis Gruner, Prof. Min. École des Mines, Paris, 6th March, and Edward Everett Hale, dated Boston, March 21, 1870.

Donations for the Library were received from the London Astronomical Society; M. Theodore Wechniaakof, of Paris; the Boston S. N. H.; the Cambridge Museum of Comparative Zoology; Mr. J. H. Trumbull, of Hartford, Dr. S. D. Gross, of Philadelphia, the Franklin Institute, the Episcopal Hospital, and the Editors of Nature.

Prof. Cope exhibited fossil fishes in black shale from Dr. Hayden's collections of 1869; from Railroad cuttings, in the Green River Country, Rocky Mountains, belonging to the salt water family of the Clupeidæ, and the brackish water family of the Cyprinodontidæ, for two of which he proposed the names, *Lithichthys pusillus* and *Cyprinodon levatus*. These make the first appearance in America, of genera known to be fossil in the rocks of Mount Lebanon. (See Proceedings below.)

Dr. Hayden described the large collections which he made in that region, and deposited at Washington. The shales are charged with bituminous matter, and exhibit multitudes of small fish, insects, freshwater-plant stems, nuts, and among other things, a true feather, as determined by Mr. Marsh, of New Haven; probably not a bird's feather, but belonging to some form of Archæopteryx.

A discussion took place respecting the law of storms as set forth in a recent memoir by M. Prestel.

Pending nominations Nos. 649 to 656, and new nominations Nos. 657, 658, were read.

And the Society was adjourned.

Newly elected members will receive their diplomas through the Smithsonian Institution, or by private hands; and all members, who have not already sent their CARTES DE VISITE for the Album of the Society, are respectfully urged to do the Society this favor at their early convenience, by mail or otherwise.